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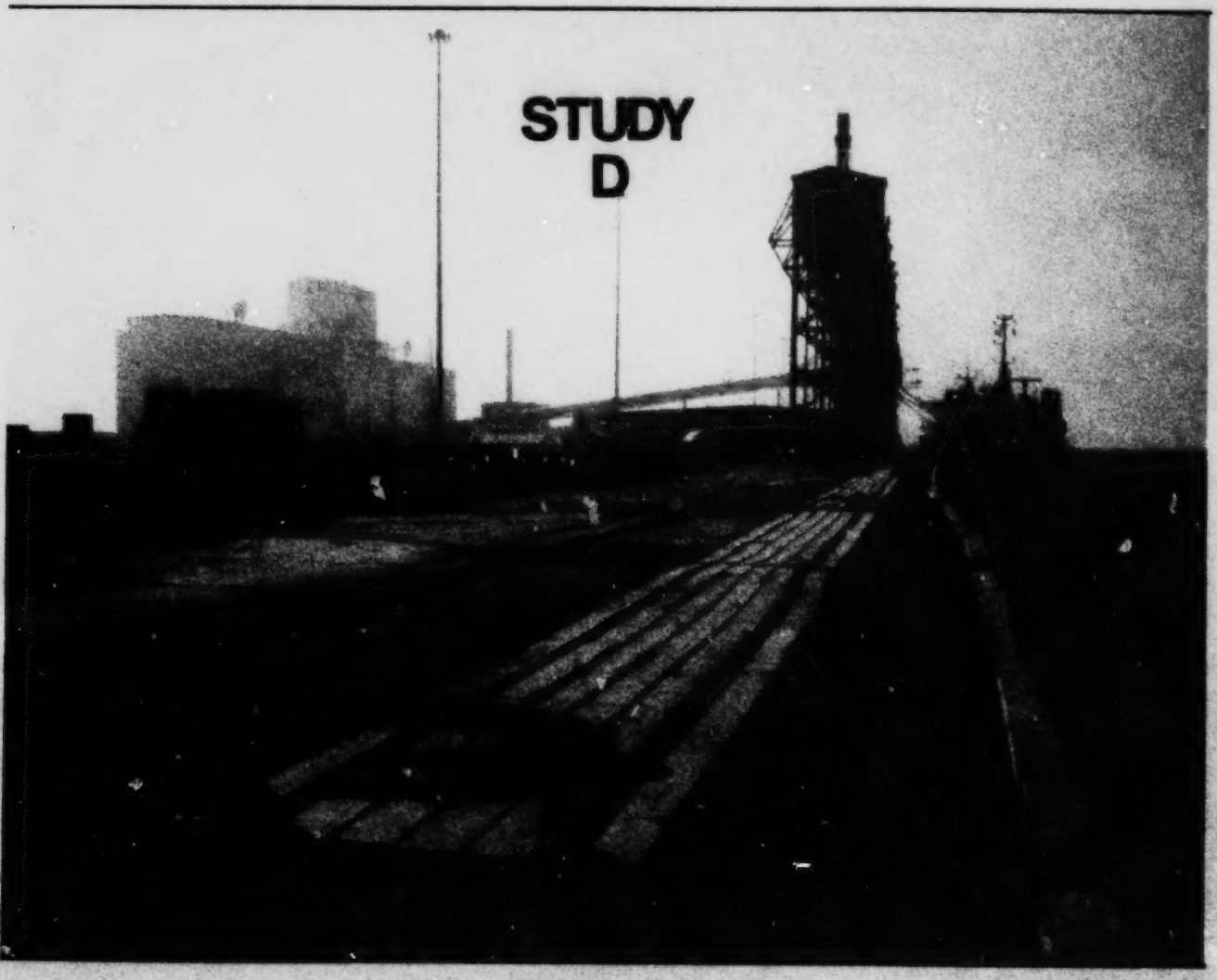
PORT OF CHURCHILL
GRAIN SHIPPING COSTS



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PORT OF CHURCHILL
GRAIN SHIPPING COSTS
STUDY D

Prepared for

GOVERNMENT OF CANADA
TRANSPORT CANADA

GOVERNMENT OF MANITOBA
HIGHWAYS AND TRANSPORTATION

by

IBI GROUP
in association with
Harry Kriss + Associates Limited
Carr & Donald & Associates
Theo Joseph
Allardice & Associates Ltd.

March, 1986

IBI
GROUP

March 26, 1986

Mr. A. Johansen
Canadian Marine Transportation
Administration
Transport Canada
21st Floor - Tower A
Place de Ville
Ottawa, Ontario
K1A ON5

Mr. J.B. Wallace
Executive Director
Transportation Policy
Programs and Research Division
Manitoba Department of
Highways and Transportation
215 Garry Street, 15th Floor
Winnipeg, Manitoba
R3C 3Z1

Gentlemen:

PORT OF CHURCHILL GRAIN SHIPPING COSTS
STUDY D

We respectfully submit the above report presenting our findings on the economics of the use of the Port of Churchill as a grain exporting port. In accordance with the contract for this work, dated July 25, 1985, this report addresses one of the four studies comprising the overall Churchill study, as follows:

A. Season Extension;

B. Additional Commodities;

C. Resupply Operations;

D. Grain Shipping Costs.

The above four studies were all carried out by IBI Group and its associated sub-consultants, on an integrated basis; the accompanying report addresses the results of Study D only. The overall findings and results of Study D are summarized in an Executive Summary at the beginning of the report. The Summary follows the same structure as the main body of the report which, of course, presents the study findings and results in substantially greater detail.

We wish to acknowledge with thanks the advice and direction of the Steering Committee for this study under your co-chairmanship and the cooperation of the many people who provided information and opinions related to the study. The consultant team bears responsibility for our findings, conclusions and recommendations, as presented herein.

We hope that the economic comparisons presented in this report will assist the Government of Canada, the Government of Manitoba and other interested parties in reaching the most appropriate policy position regarding the Port of Churchill, in the long term interests of the country.

Yours sincerely,

IBI GROUP

Neal A. Irwin
Managing Director

Lee S. Sims
Director

NAI/LSS/wp
Encl.

The contents of this report reflect the opinions of the Consultant and are not to be construed as the official policy of Transport Canada or Manitoba Highways and Transportation.

Dimensions and measurements contained in this report may appear in both imperial and metric units as a reflection of common usage and standard practice of the transportation industry.

ACKNOWLEDGMENT OF PARTICIPATION

This Study (Port of Churchill Grain Shipping Costs) was conducted on behalf of the Government of Canada, Transport Canada, and the Government of Manitoba, Department of Highways and Transportation, under the Canada-Manitoba Subsidiary Agreement on Churchill.

Consultant support to the IBI Group, the main consultants, was provided by the following firms:

Harvey Kriss + Associates Limited - Management Consultants

Carr & Donald & Associates - Consulting Engineer

Theo Joseph - Grain Trade Consultant

Allardice & Associates Ltd. - Marine Consultants

A multi-disciplinary steering committee composed of representatives from Transport Canada and the Manitoba Department of Highways and Transportation provided overall direction and facilitated information exchange with relevant organizations and individuals. The governments of the Province of Alberta and the Province of Saskatchewan also provided senior support to the steering committee and the study.

The contribution of all participants is gratefully acknowledged. Responsibility for the findings and conclusions presented herein rests with the consultants.

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PORT OF CHURCHILL GRAIN SHIPPING COSTS

STUDY D

EXECUTIVE SUMMARY

1. STUDY OBJECTIVES AND SCOPE

This study was conducted on behalf of the Government of Canada, Transport Canada, and the Government of Manitoba, Department of Highways and Transportation, under the Canada-Manitoba Subsidiary Agreement on Churchill. It is part of an overall study of the Port of Churchill conducted on an integrated basis by IBI Group and its associated consultants, with the following components:

- Study A: Season Extension;
- Study B: Additional Commodities;
- Study C: Resupply Operations;
- Study D: Grain Shipping Costs.

This executive summary provides a brief overview of the objectives, scope, major findings and conclusions of Study D.

Objectives

As stated in the Terms of Reference, the study objectives are as follows:

A. "to clarify and explain the costs, and the elements of such costs, of moving grain by sea from Churchill within existing seasonal limits to foreign destinations over the past five years. No other type of cargo movement is to be considered."

B. "to identify and analyze any cost advantages that may obtain through the use of Churchill."

C. "to recommend any courses of action which may be taken, from the marine transportation aspect, to increase the utilization of the Port during the existing season, for the export of grain."

Study Scope

Reflecting the consultant's proposal and discussions at the commencement of the study, it was agreed that the scope as outlined above would be expanded to include an analysis of both rates and relevant costs which may not be reflected in current rates, for the export movement of grain by land to Churchill and by sea to typical overseas markets. The rates and costs for exporting grain through Churchill are to be compared with those of exporting grain through the alternate ports of Thunder Bay and typical lower St. Lawrence ports.

The study is also to explore the potential effects of selling grain on CIF (cost, insurance and freight) or other marine contract bases and to review other factors including chartering options, insurance costs, ice conditions, vessel availability and price and any others which affect the export of grain from Churchill. Finally, the study is to draw conclusions on the factors that influence the viability of Churchill as a grain exporting port and on the factors that influence the viability.

The sections of this Executive Summary mirror the chapter structure of the main report.

2. GRAIN MOVEMENT PATTERNS

During the 30 year period 1956-1985, movements of export grain through the Port of Churchill have averaged about 573,000 tonnes per year; the highest throughput was 755,200 tonnes in 1977 and the lowest was 308,800 tonnes in 1980. There has been a declining trend generally since

1977, and the average throughput over the past ten years was 545,000 tonnes per year. During the same period total grain exports from Canada to Atlantic destinations (Europe, Western and North Africa, the Mediterranean Coast of Asia and the East Coast of South America, the markets for grain that passes through Churchill), increased by about two-thirds. Most of this grain was exported through Thunder Bay and the St. Lawrence system.

During the period 1960-1973, 54 percent of the grain exported through Churchill went to the United Kingdom and 88 percent to Western Europe in total, with only 6.6 percent to Eastern European nations. During the period from 1974-1985, 56 percent of Churchill grain was shipped to Eastern Europe, compared to 24 percent to Western Europe; there was also a significant increase in shipments to Mediterranean and Persian Gulf destinations, from 3.7 percent in 1960-1973 to 15.8 percent in 1974-1985. In most years since 1971 the practice of the Canadian Wheat Board (CWB) has been to ship either wheat or barley almost exclusively in a given year through Churchill.

An examination of weekly grain receipts at the various export grain terminals in recent years indicates that, during the Churchill shipping season (normally about 12 weeks between the last week of July and the third week of October), the total movement of grain to all terminal elevators does not increase significantly and there is a reduction of grain flows through Thunder Bay while grain is being received at Churchill. No corresponding interaction is evident between Vancouver and Churchill flows.

The two main conclusions drawn from the analysis of grain movement patterns are as follows:

- grain exports to destinations served by Churchill are growing and are expected to continue to grow;
- during the Churchill navigation season, Churchill and the Thunder Bay/St. Lawrence route tend to be in competition for grain traffic with many of the same destination countries being served by both routes.

3. ANALYSIS OF RATES AND COSTS

In recent years, the majority of grain shipped to Churchill has originated from CN shipping blocks in Northern Saskatchewan and Northwest Manitoba which have a lower rail rate to Churchill than to Thunder Bay or the West Coast. As shown in Exhibit 3.2 of Chapter 3, the Churchill rail rate advantage area lies east of a north-south line slightly east of Lloydminster and north of an east-west line which passes between Saskatoon and Moose Jaw. The advantage in total rail rates (including the shipper's share and the federal government contribution) to Churchill versus to Thunder Bay in the current crop year is 92¢ per tonne from Saskatoon and $3.70 from Melfort, Saskatchewan. During the period 1978-1982 an average of 78 percent of wheat and barley shipments to Churchill originated at delivery points within the Churchill rail rate advantage area; this percentage dropped slightly to 72 percent during the period 1983-1985. Our analysis indicates that Saskatoon approximates the average source for grain shipped through Churchill. The weighted average rail rate advantage achieved relative to grain moving through Thunder Bay is about 95¢ per tonne, including grain shipped from outside of the Churchill rail rate advantage area, whereas grain from Saskatoon has an advantage of 92¢ per tonne to Churchill compared to Thunder Bay. It is recognized that, while the Canadian Wheat Board experiences these rail rate savings for grain shipped via Churchill, there are other costs of shipping grain to Churchill which are borne by all grain shippers in Western Canada and which may counterbalance these rate savings. This is dealt with in Section 4 below.

An extensive analysis was carried out of ocean shipping rates from Churchill and other Eastern Canadian grain exporting ports to destinations in Western Europe, and detailed analyses of ocean shipping costs were also carried out for the same routes, including development and application of an ocean shipping cost model. Three alternate marine routes were subjected to this analysis:

- o Churchill to Northwestern Europe (e.g., Rotterdam);
- o Thunder Bay directly to Northwestern Europe with an ocean going vessel; and
- o Thunder Bay by laker to a lower St. Lawrence port with transshipment there to an ocean going vessel to Northwestern Europe.

It was found that marine rates on these and other routes have been subject to substantial cyclical fluctuations, with recent peaks in 1974 and 1980, "medium" levels in 1975, 1979 and 1981, and low levels in 1972, 1977 and 1983-1985. These trends are illustrated in Exhibit 3.9 in Chapter 3. Rates in years of strong ocean freight markets (reflecting high demand relative to the supply of vessels) are typically about twice as high as rates in years of low ocean freight markets (an oversupply of vessels relative to demand).

Ocean shipping costs (i.e., capital and operating costs experienced by the shipping companies as opposed to the shipping rates which they charge) were also examined to put the rate comparisons in perspective. They have been substantially more stable over the years. Typically, marine shipping costs between, for example, Baie Comeau and Rotterdam for grain, with a 50 percent backhaul, are estimated to be about three-quarters of the rate charged in a medium ocean freight market year; however, costs are significantly higher than rates charged in low ocean freight market years while profit margins are greater in high market years.

Comparisons were made of the total rates paid for moving wheat from Saskatoon, Saskatchewan to Northwestern Europe (e.g. Rotterdam) through Churchill and through Thunder Bay including full rail rates and terminal elevator charges as well as marine transportation rates and transfer elevator rates at a lower St. Lawrence port for grain moved by laker vessel from Thunder Bay. To reflect the effects of the cyclical fluctuations in ocean marine rates as noted above, these comparisons were

carried out for low, medium and high ocean freight markets. As shown in Exhibit 3.14, from Chapter 3 of the report, the total rate via Churchill is lower than the total rate via Thunder Bay direct (with an ocean going vessel) or via Thunder Bay and a laker vessel (with transfer at a lower St. Lawrence port), for all three ocean freight market scenarios.

During medium ocean freight market conditions the total rate via Churchill (in 1985 dollars) is about $14.00 less than via Thunder Bay direct and about $12.40 per tonne less than via Thunder Bay and a St. Lawrence port. During years of low ocean freight market conditions the total rate via Churchill is about $7.00 per tonne less than via Thunder Bay direct and about $17.00 per tonne less than via Thunder and a St. Lawrence port; during high ocean freight market years these differences are about $10.00 per tonne and $6.00 per tonne, respectively. Similar comparisons were carried out for other Prairie origins which, as illustrated in Exhibit 3.17, show that when total rail, elevator and marine rates are taken into account (rather than simply the rail rates) the "Churchill total rate advantage area" is very much larger, including virtually all of Saskatchewan and a substantial portion of Western Manitoba, including Dauphin.

4. COST COMPARISONS

As has been pointed out in a number of recent studies, there are certain cost elements (e.g., rail line related costs), not currently reflected in the rate structure upon which the previous sections were based, which should be taken into account in comparing the total grain transportation cost to Canadians and to overseas grain customers for grain shipped via the three routes described above. Because a number of these cost elements contain fixed costs (which do not vary with the amount of grain handled), the cost per tonne of grain throughput varies with the level of throughput, with decreasing costs per tonne at higher throughput levels. In order to take this into account, the total comparisons (based on the additional cost elements described in Chapter 4) for the three routes were carried out under six grain throughput scenarios for the Port

of Churchill: zero throughput, 250,000 tonnes per year, 500,000 tonnes per year, 750,000 tonnes per year, 1,000,000 tonnes per year and 1,250,000 tonnes per year, with corresponding variations in the Thunder Bay grain throughput.

Chapter 4 of the report presents an extensive discussion of various cost elements and the reasons for including some of these and not including others in the comparison. Among the elements discussed are those relating to the grain collection system, port and terminal facilities and the marine transportation system. Within each of these systems the possibility of there being costs that are not adequately reflected in the rates or which would change the rates for different magnitudes of Churchill shipping programs on the Churchill route or on the alternative routes is discussed.

Grain Collection System

It was concluded that within the grain collection system (including the primary elevator) there was no evidence that the Churchill shipping program incurred costs any higher than the movement of the same grain on an alternative route.

Rail Transportation System

The current rail rate structure is based on distance alone with no variation in the rates charged by origin area or by destination. It was concluded that the railway rates charged under the Western Grain Transportation Act (WGTA) reflect grain movement costs in an adequate manner in general but that it is not possible to attribute specific costs to particular movements without a very detailed enquiry into the costs of various routes which would have to be much more detailed than previous studies of railway grain movement such as the Hall and Snavely enquiries.

There are some railway volume related costs associated with conditions on the Churchill line which will be required to maintain service which are not required on other routes. Difficult soil conditions now require only boxcars to be used on this route. As described in substantial detail in Chapter 4 and Appendix E of the report, while the number of boxcars is sufficient currently and for the next few years, it is anticipated that there will be insufficient boxcars for this purpose by 1991-1992. In order to address this problem, one of three basic actions will be required to continue grain deliveries by rail to Churchill:

- rehabilitate additional boxcars; in this case there will be an additional capital cost as well as additional operating costs associated with movement of these boxcars;
- purchase specialized equipment for the Churchill route such as the articulated hopper car that has been developed and a prototype of which is now being tested on the Churchill line by CN; again, there will be capital and additional operating costs associated with this option compared to the use of conventional hopper cars;
- refurbish the Churchill line (through the use of "cryo-anchors" to avoid thawing of perma-frost sink holes during the summer which currently can cause road-bed problems sufficient to derail conventional hopper cars) in order that conventional hopper cars can move on the Churchill line.

More information on the three alternatives is expected to be available later based on current studies being carried out by CN under the Canada-Manitoba Subsidiary Agreement on Churchill and drawing on the results of the prototype articulated hopper car tests and other analyses. A preliminary assessment of the three alternatives, carried out as part of this study and described in Appendix E suggests that under certain assumptions the articulated hopper car approach may be the most cost-effective but that either of the other two approaches might prove more cost-effective depending on factors such as the useable life of rehabilitated boxcars, capital and operating costs of the new articulated

hopper cars, and the actual cost of refurbishing the rail line. For purposes of this study, the additional annual costs of the articulated hopper car approach were used; as described more fully in Chapter 4 the annualized costs associated with an articulated hopper car program are similar to the annualized costs estimated for a boxcar rehabilitation program.

There are also three existing line related costs associated with the use of the Churchill rail line which are significant to the comparison:

- o $680,000 for 1985/86 as a special subsidy paid to CN out of WGTA funds for additional line related costs of the line from Thompson Junction north to Churchill;
- o $2,281,000 for the basic line related costs of the Herchmer Subdivision (from Gillam to Churchill) as a grain dependent branch line which is included in the WGTA rate base and therefore paid by all grain shippers and the federal government unlike the line related costs of the routes to other ports; and
- o $1,657,000 for line related costs of the northerly section of the Thicket Subdivision (from Thompson Junction to Gillam) now paid by CN and other shippers.

If the Churchill line is maintained in operation these costs totalling about $4.6 million must be met by the grain shipper or by others.

Port and Terminal Facilities

Another set of cost elements relates to port and terminal facilities, including interest charges on capital facilities, terminal elevator costs, extra Canadian Grain Commission inspection costs at Churchill, extra costs of unloading boxcars, overtime charges for elevator use, and capital costs of future improvements. The conclusion of this part of the analysis is that there are certain additional costs associated with maintaining Churchill port and terminal facilities in operation which would not be reflected in additional costs at other ports if the route were no longer used for grain.

Marine Transportation System

The final set of cost elements considered relates to the marine transportation system, including items such as the St. Lawrence Seaway tolls, and additional Transport Canada and Canadian Coast Guard en route costs associated with operation of the Hudson Bay route in addition to the actual freight rates charged from the ports to the final destination overseas. The comparison indicates that there is a marine freight rate advantage for grain that is moved from Churchill, net of the impacts of the other factors. Including the full value of the marine freight rate differential in the comparison between routes makes the implicit assumption that the prices for grain that the Canadian Wheat Board realizes at each port will fully reflect the freight rate differentials of the alternative routes to the overseas destinations. The comparison uses the marine rates actually paid for voyages from Churchill, Thunder Bay and lower St. Lawrence ports to Northwestern Europe (Antwerp to Hamburg). These were used as representative of the rate differentials for the routes from Churchill ports to the actual destinations to which most Churchill grain is going.

Analysis of Results

Estimates are then made in Chapter 4 of the relative total cost advantages/disadvantages in grain transportation and handling that would be expected to result from the different levels of Churchill throughput referenced earlier. In each case, the comparison is with the option of moving no grain through Churchill. The analyses are carried out and the results presented for 1986/87 crop year and for the 1991/92 crop year, that is with and without the costs associated with acquiring and operating new rail equipment for the Churchill service which will be necessary by the latter year. Because of the significance of the railway line related costs, the results are presented for each of the two years with and without the additional line related costs. A summary of the results is presented in Exhibit 4.11.

If the Churchill line is not used for grain movement in future, an important question must be addressed: Will the line will be completely abandoned or will it continue to be used for carrying other traffic? If the line would be kept open even if no grain were carried on it, then the line related railway costs should not be included in the comparison, since these costs would still have to be borne by government, the railway or other shippers even though they would no longer be paid by grain shippers. On the other hand, if the rail line would be completely abandoned, then the line related costs should be included in the comparison since they would in fact be "saved" by the Canadian transportation system and shippers. There would, of course, be other cost implications of completely abandoning the Churchill line associated with disruption and dislocation of the other users of the line and the communities served by it as well as reductions in Canada's ability to achieve national objectives related to sovereignty, defence, Northern development and resupply of Arctic communities but these are among the considerations that are relevant to addressing the issue of complete abandonment of the Churchill line rather than the issue of use of the Port for grain exports.

The results of this analysis are also sensitive to the assumption that the prices for grain realized at the ports reflect the actual freight rate differentials from the ports to the overseas destination. While it is reasonable to assume this, if a larger discount has to be offered at Churchill (relative to the lower St. Lawrence) then the benefits of shipping grain through Churchill would be reduced.

The following conclusions flow from the cost comparisons described in Chapter 4:

1. There is a marine transportation advantage associated with the use of Churchill compared to Thunder Bay for grain moving to Northwestern Europe and other Atlantic markets.

2. This marine transportation advantage more than compensates for the total costs associated with using the

Port and terminal facilities, for higher volumes of grain movement through Churchill.

3. To the extent that the CWB captures the marine freight advantage in the prices charged to buyers, these differences will represent a gain to Canada and to grain growers.

4. There are also railway system costs associated with the Churchill route which are not specifically reflected in the Churchill rates. These costs are associated with the need to have specialized cars for use on the Churchill line (volume related costs) and with the cost of maintaining the line to Churchill (line related costs) which are currently charged to grain transportation.

5. The economic advantage of using the Churchill route for grain movement is reduced if the volume related additional rail costs are taken into account (e.g., to provide special rail equipment to operate on this line), but there would still be an advantage for Churchill grain throughput levels above about 600,000 tonnes per year by 1991/92.

6. When the costs of maintaining the Churchill line in operation are included as a cost of shipping grain through Churchill (and most of these are currently attributed to grain transportation), the Churchill route shows an overall advantage for movements over about 850,000 tonnes under the current railcar supply situation for average ocean freight rates. When new cars would be required for shipment through Churchill (by 1991/92) use of Churchill at annual throughputs would result in a cost penalty under about 1.25 million tonnes annually over the long run when the full range of ocean freight rate market situations are encountered.

7. It is not at all certain that the rail line from Thompson Junction to Churchill would be abandoned if grain were no longer shipped through Churchill. In this case these line related costs would not be actually saved by eliminating the Churchill grain program and the economic comparison should not include the cost of maintaining the Churchill line in operation. In this case there would be an economic advantage in using Churchill for higher throughput levels, even by 1991/92 when new cars would be required, for annual throughputs above about 600,000 tonnes.

8. It does not seem equitable to charge grain shippers for all of the line related costs of the Churchill route unless this line is maintained specifically for the movement of grain. If in fact the line would not be abandoned if grain were no longer shipped, then consideration should be given to paying some or all of the line related costs out of general government revenues, reflecting the importance of the Hudson Bay route for Canadian sovereignty, defence, Northern development and Arctic resupply as noted earlier.

9. If the Port of Churchill is kept open for grain exports, the greater the volume that is shipped the better off are the grain shipper and the overall grain transportation system. Higher costs occur when Churchill is kept open but only relatively small volumes of grain are shipped through the Port.

5. OCEAN SHIPPING ARRANGEMENTS

Chapter 5 presents an assessment of alternative ocean shipping arrangements for grain, in terms of their potential usefulness as a means of attracting more grain traffic through the Port of Churchill.

Currently, FOB (Free on Board) is the predominant shipping option used at Churchill. Under this option, as illustrated in Exhibit 5.1 of Chapter 5, the seller (or his agent) pays to load the vessel at the Canadian port and the buyer (or his agent) pays all other ocean shipping costs including ocean freight and cargo insurance. The major alternative to FOB is CIF (Cost, Insurance, Freight) under which the seller pays to load the vessel and also for the ocean freight and insurance costs. C&F is a variation on this under which the seller pays to load the vessel and for the ocean freight but the buyer pays for the cargo insurance. The fourth ocean shipping option discussed is C of A (Contract of Affreightment), under which there is a special contract between the seller and the shipowner or the buyer and the shipowner to move a specified large volume of a commodity between a specified set of origins and destinations over an extended time period (often several years). Such an arrangement might typically be used for moving a large annual volume of ore from a mine to an

overseas smelter every year but is rarely seen in the more volatile grain trade.

The overall conclusion of our assessment of alternative ocean shipping arrangement options for Churchill grain exports is that an increased use of CIF shipments by the Wheat Board would not significantly improve the level of use of the Port of Churchill. The major buyers of grain from Churchill over the past six years have been Eastern Bloc and Third World Nations which have state shipping fleets and would therefore wish to continue buying grain on an FOB basis. Shipments to Northwest Europe would be more suitable for possible CIF arrangements, but shipments to these destinations are currently being handled by accredited exporters (multi-national grain companies acting on behalf of the Canadian Wheat Board) which have considerable experience in the ship chartering business. There is little reason to believe that the Wheat Board would be able to achieve significantly lower ocean rates if it were to enter the business of chartering vessels on a regular basis. Under certain special circumstances, in particular during a period of a rapidly rising ocean freight market, there might be some opportunity for the Wheat Board to gain ocean rate savings by chartering vessels on a time basis for repeated voyages, but such an arrangement would also carry with it considerable risks to the Board.

Overall, therefore, while a CIF arrangement would potentially allow the Board to control its shipping arrangements more fully and therefore direct more vessels to Churchill, the impracticality of such arrangements with Eastern Bloc and Third World buyers and the risk involved in such arrangements with other buyers are such that alternative methods of arranging ocean freight from Churchill hold little potential, in the view of the study team, for increasing the use of the Port relative to the existing FOB arrangement.

6. PORT CAPACITY ANALYSIS

Chapter 6 of the report presents an analysis of the grain throughput capacity of the railway system, elevator and ship loading facilities comprising the Port of Churchill grain transportation/handling system. It is important to understand the levels of throughput which can be achieved by the Churchill system under various operational and vessel arrival circumstances and the average vessel waiting time that would likely result at various levels of throughput, the components of the system which are the limiting factors on its capacity under various circumstances, and the implications of this in terms of improving the system and its economics.

In order to assess these questions systematically, a computerized model was developed to simulate Port operations including: train movement, railcar unloading, grain cleaning, vessel loading, and vessel movements at the Port. The model is described in Appendix F and its results are discussed in Chapter 6. It was calibrated in terms of 1985 operations and was able to reproduce the operational features and vessel delays actually observed at the simulated throughput levels, within reasonable tolerances. As a further test, the model was operated for throughput levels and number of arriving vessels similar to those experienced in 1976 (a year of large grain throughput) and again the model was able to reproduce with reasonable accuracy the vessel delays actually experienced that year.

Some thirteen additional runs of the Port capacity model were carried out, as summarized in Exhibit 6.1 of Chapter 6, to simulate operating conditions at annual throughput levels of 700,000 tonnes, 1,050,000 tonnes and 1,400,000 tonnes, respectively, under various conditions of: ship arrival patterns; number of hours per day worked for unloading railcars, cleaning grain and vessel loading; and the amount of available elevator capacity for storage.

The conclusions drawn by the study team from the simulation results are as follows:

- the practical capacity of the elevator, assuming the present configuration, is approximately one million tonnes per year during the current shipping season, or about 85,000 tonnes per week over 12 weeks;

- if vessel arrivals could be made more uniform and grain arrivals coordinated with these vessel arrivals, the capacity could be higher, in the order of 1.4 million tonnes per year;

- on the basis of the spread of types of grain analyzed (three different types of grain were used in the simulation runs) the amount of storage provided by the elevator was found to be balanced with the handling rates;

- the only practical basis to increase throughput would be to increase all three handling rates including unloading, cleaning and vessel loading. At 700,000 tonnes per year throughput, with 20 hours per day of operation for car unloading, grain cleaning and vessel loading, the estimated average vessel waiting time would be about 4.3 days; this would rise to about 8.1 days with only 10 hours per day of vessel loading. At 1,050,000 tonnes per year throughput, the estimated average vessel waiting time would be about 7.6 days with 20 hour unloading shifts, and this would drop to an estimated 6.9 days if the shifts were increased to a 24 hour per day operation. At 1,400,000 tonnes per year throughput, vessel waiting times would rise to over 10 days on average unless the number of grain types were reduced or the vessel arrivals are uniform rather than random; under the latter situation, the estimated average vessel waiting time would drop to about 3.7 days.

The results confirm that, with multiple shift operations, the Port and its rail and ocean interfaces are capable of handling one million tonnes in a 12 week season and, under controlled circumstances, this level could be exceeded.

7. CONCLUSIONS AND RECOMMENDATIONS

The economic analyses presented in this report indicate that use of the Port of Churchill and the rail line serving it as a route for export grain is likely to be economically viable into the 1990's under medium or low ocean freight market conditions, and under medium or high world grain market conditions provided that the grain throughput levels are in the order of 600,000 tonnes per year or higher through the Port. This conclusion is based on the premise that the line related costs of the rail line (currently about $4.6 million per year) are government-subsidized (in recognition of the Port's broader role and strategic significance) rather than being borne by the grain shipper.

The policy question to be addressed is whether the potential savings in grain transportation/handling costs and the other strategic reasons for continuing the Port and rail line in operation are sufficient to decide in favour of their continuing operation, recognizing the subsidy requirement for rail line related costs. In addressing this question governments and other interested parties should consider the broader policy implications of ceasing the movement of grain through Churchill and abandoning the rail line. Among these policy implications (which are beyond the scope of analysis of this study), in addition to the immediate strategic and Northern development factors mentioned earlier, is the consideration that the rail line and the Port do exist, the marginal cost of maintaining them in operation for grain exports is modest, they may be badly needed during the coming decades for strategic reasons and possibly for grain exports, and their future replacement costs if abandoned now would be large.

If the policy decision is to maintain the rail line and Port, then export grain traffic through this outlet should be maintained at substantial levels both because of the savings that would result from its use at such levels and because it is the major existing economic contributor to continuing operation of the line and Port. The recommendations presented

below are submitted to assist in on-going development and operation of the Hudson Bay route if this policy option is selected:

1. In terms of grain exports the Port will be economically viable only for higher levels of grain throughput, beyond approximately 600,000 tonnes per year. Maintaining the Port and the railway line and not using it at or above such throughput levels is the worst option in terms of the economics of handling and transporting export grain.

2. Some investments would be required in the elevator under these conditions. The major one is the implementation of a dust control system which will permit the elevator to meet regulatory standards and improve the safety and environment of the workers, at a capital cost of about $5 million in 1985 dollars. The cost of this improvement has been included in the economic comparisons.

3. The line related costs of the Churchill line, currently about $4.6 million per year, should be paid for out of general government subsidies, rather than out of subsidies ear-marked for grain transportation and out of grain freight rates, as a large proportion of these costs are paid now. This would be consistent with the underlying policy decision to maintain the line and the Port in continuing operation for the reasons cited above.

4. To maintain grain service on the Churchill route will require action to ensure a supply of cars. In the short term this may be done by an interchange agreement between CP and CN to permit CP cars to be used for this movement. This may also reduce railway operating costs somewhat. Over the longer term three options are possible: rehabilitation of additional boxcars, construction of new cars specially designed for the line such as the articulated hopper car now under development, or refurbishment of the line so that it can handle conventional hopper cars. An early decision on the best method is required so that design and methods of financing can be developed. The estimated costs of this articulated hopper car option were included in the economic comparisons.

5. Consultation should take place among the Canadian Wheat Board, the Governments of Canada and Manitoba and other interested parties in order to reach a consensus on how

to achieve the benefits associated with the use of the Port of Churchill for grain exports.

6. Overseas buyers and shipowners should be made more familiar with operations through the Port of Churchill. It was found that some had an "irrational" fear of taking delivery of grain through the Port. The Governments of Canada and Manitoba have already made a start in this by familiarizing the international insurance business with Port operations and improvements made to the operation of the sea routes to and from Churchill.

7. Better communications and information services should also be established to ensure that captains sailing to and from Churchill, particularly early and late in the season are fully informed about ice conditions and that the Canadian Coast Guard is informed of vessel arrivals and departures so that ice breaking escort services can be provided on a timely basis. This is discussed more fully in the Study A report.

If the decision is taken that the line should be closed over the long term then the study team has the following conclusions and recommendations:

1. Today, with existing car supply, the Port should be used for Churchill volumes of over about 800,000 tonnes per year. If this volume can be achieved then the Port and railway line should be kept open until attrition in the boxcar fleet no longer permits this level of throughput.

2. The elevator and the line should be maintained in safe operation for this period with a minimum of new capital investment.

The conclusions as to the viability of the port are also based upon the assumption that the Canadian Wheat Board can sell grain at Churchill for a price which reflects the actual marine transportation cost differential for onward delivery of the grain. While CWB commercial secrecy precludes verifying this assumption there is reason to believe that it is largely true in years of normal and strong grain markets and that discounts in years of weak grain sales would still be less than the entire marine freight rate differential.

In the meantime, it is hoped that the economic comparisons presented in this report will assist the Government of Canada, the Government of Manitoba and other interested parties in reaching the most appropriate policy decision, in the long term interests of the country and its various regions.

1. INTRODUCTION

At present the Port of Churchill is used mainly for two functions:

- o the export of Canadian grain;
- o the resupply of Arctic communities, mostly in the northwestern section of Hudson Bay.

Most of these port operations take place within a very limited twelve week navigation season as defined under the Arctic Waters Pollution Prevention Act.

This study is one of four that was commissioned by the Governments of Canada and Manitoba under the Subsidiary Agreement on Churchill to study the future of the Port of Churchill. The other studies were concerned with the feasibility of extension of the navigation season at Churchill, analysis of the potential for shipping additional commodities through the Port, and an examination of resupply operations at Churchill. This study's purpose is to examine the costs associated with the movement of grain through Churchill.

1.1 OBJECTIVES OF THE STUDY

The objectives of the study were defined in the Terms of Reference to be as follows:

> "To clarify and explain the costs, and the elements of such costs, of moving grain by sea from Churchill within existing seasonal limits to foreign destinations over the past five years. No other type of cargo movement is to be considered.
>
> To identify and analyze any cost advantages that may obtain through the use of Churchill.
>
> To recommend any course(s) of action which may be taken, from the marine transportation aspect, to increase the utilization of the port during the existing season, for the export of grain."

1.2 STRUCTURE OF THE REPORT

Chapter 2 of this report provides background on the volumes and types of grain that are moved through the Port of Churchill. In Chapter 3, current grain handling and transportation rates for the movement of the grain are examined, both for routes utilizing the Port of Churchill and for competing routes. Chapter 3 concludes with an analysis of the relative rates for shipping grain from the Prairies to an overseas destination.

Chapter 4 analyzes the total handling and transportation costs related to moving various volumes of grain through the Port of Churchill. Various methods of organizing the shipment of grain are investigated in Chapter 5. Chapter 6 describes the development of a computer model which was used to analyze the potential capacity of the Port under various situations and provides the results of these analyses. Chapter 7 presents the conclusions and recommendations of the study team.

2. GRAIN MOVEMENT PATTERNS

In this chapter we first present an overview of Canadian grain export patterns, including historical and forecast future movements. We then examine the historical patterns of grain exports through Churchill in the context of overall Canadian exports. Finally, we examine weekly receipts of grain at terminal elevators to assess the possible impact of Churchill on grain movements through Thunder Bay and the West Coast.

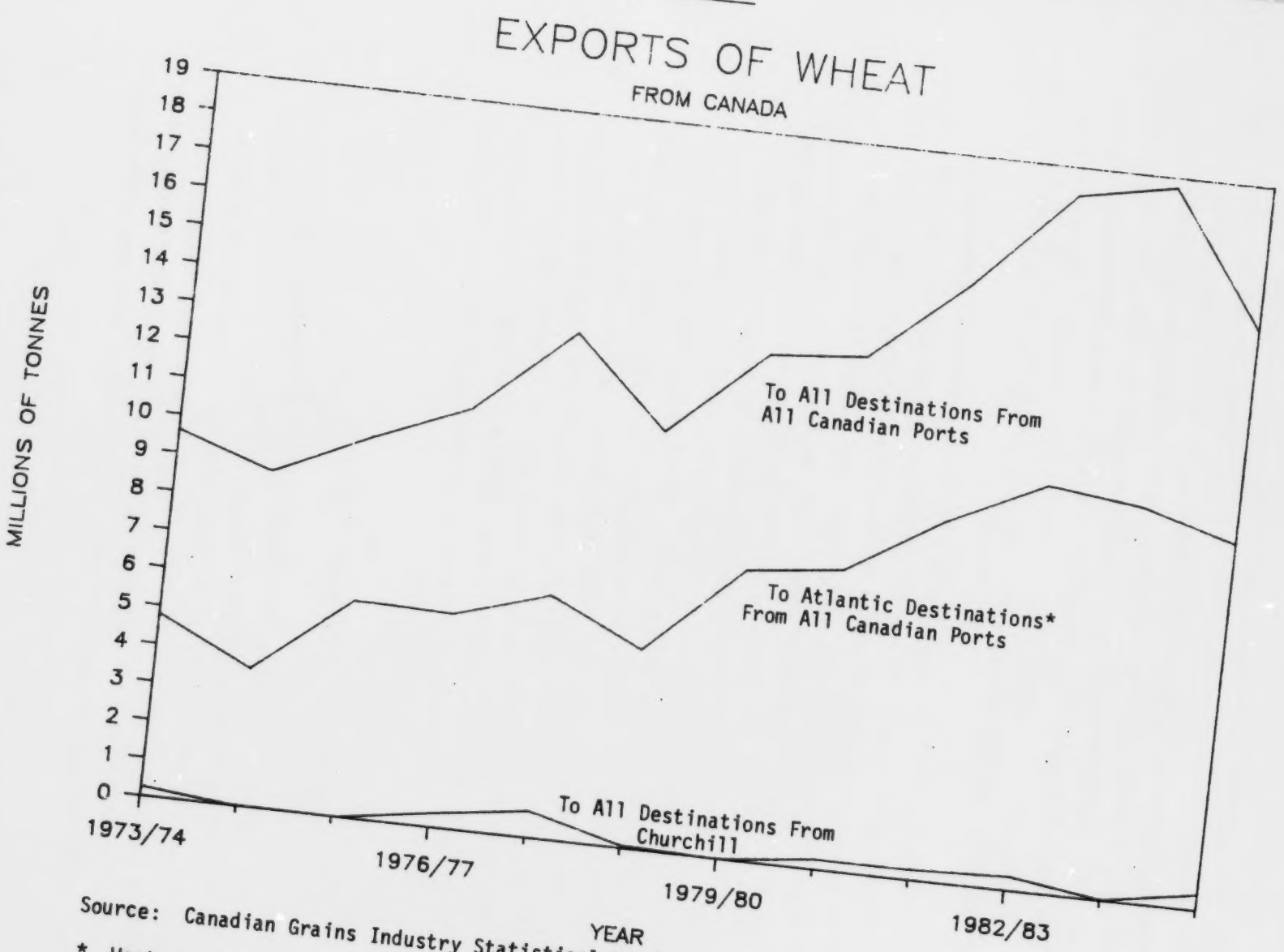
2.1 CANADIAN GRAIN EXPORTS

Exhibits 2.1 to 2.3 plot exports of wheat, barley, and wheat and barley combined from Canada as a whole to Atlantic destinations and all destinations and from Churchill to all destinations, for the period 1973/74 to 1984/85. Exports to Atlantic destinations (including Baltic and Mediterranean ports) have been shown separately because grain exports from Churchill, Thunder Bay and the St. Lawrence ports historically have moved predominantly to this destination group (details of the destinations of Churchill grain exports are given in Section 2.2), while West Coast exports have gone mainly to Pacific destinations. Wheat and barley constitute the main Canadian Wheat Board (CWB) grains exported (exports of the other Board grain - oats - have been in the range of 50,000-150,000 tonnes per year in the past few years). It is seen that since 1973/74, Canadian grain exports have been growing steadily both in total and to Atlantic destinations. Exports through Churchill, however, have shown a stationary trend throughout the period and have been falling as a percentage of Canadian grain exports.

2.1.1 Geographical Distribution of Exports

Exhibit 2.4 shows the distribution of Canadian wheat exports since 1973/74 by major destination region. In general, exports to Western Europe have been relatively stationary over the period, while exports to Eastern Europe and the Mediterranean have quadrupled over the same period. Exports to Asia have also been growing but at a lower rate than exports to Eastern Europe and the Mediterranean. In 1984/85, a poor crop year, wheat

EXHIBIT 2.1



Source: Canadian Grains Industry Statistical Handbook - 1984 and 1985

* Western and Eastern Europe, Western Africa, Eastern South America and the Caribbean

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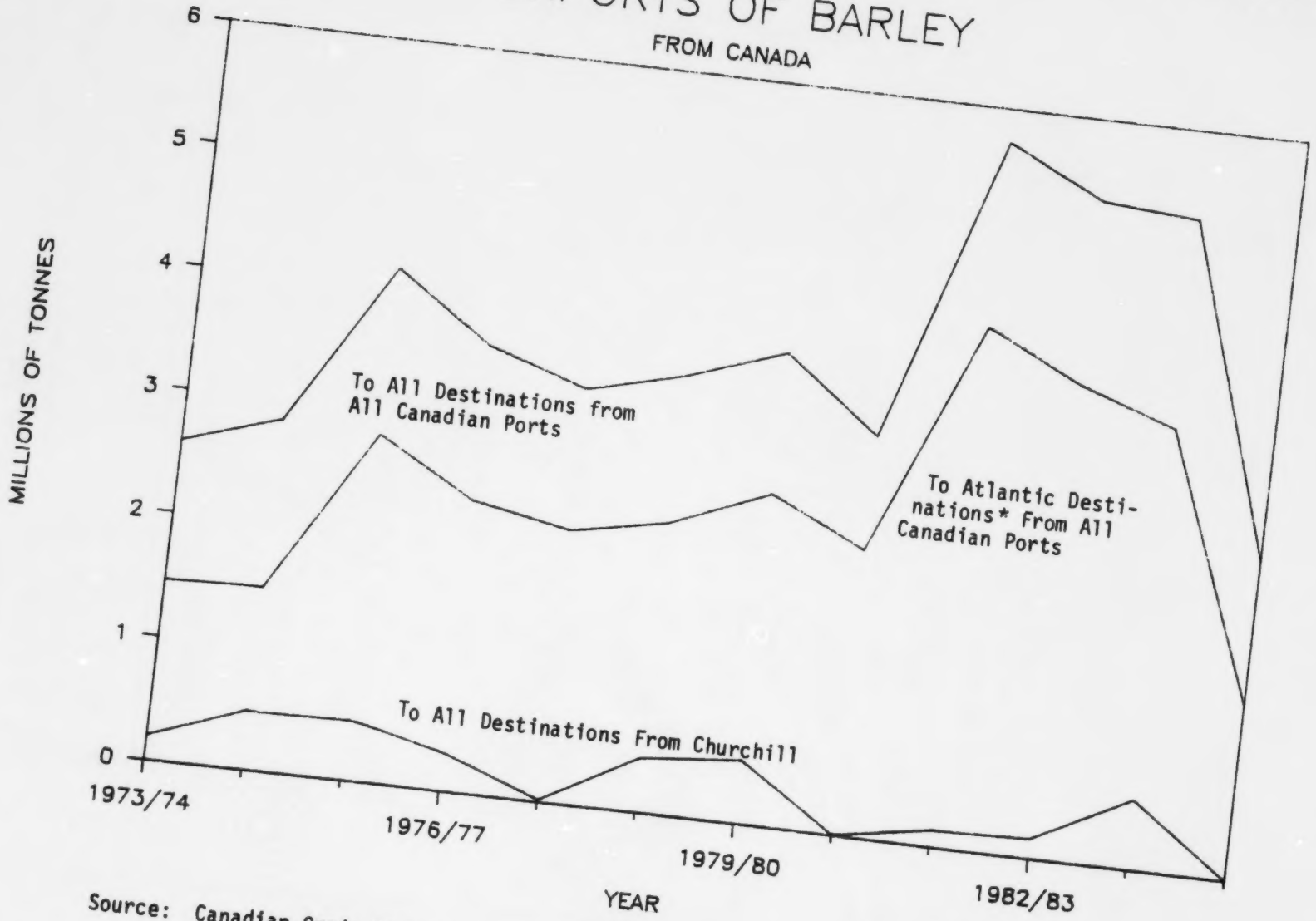
EXHIBIT 2.2

EXPORTS OF BARLEY FROM CANADA



Source: Canadian Grain Industry Statistical Handbook - 1984 and 1985

* Western and Eastern Europe, Western Africa, Eastern South American and the Caribbean

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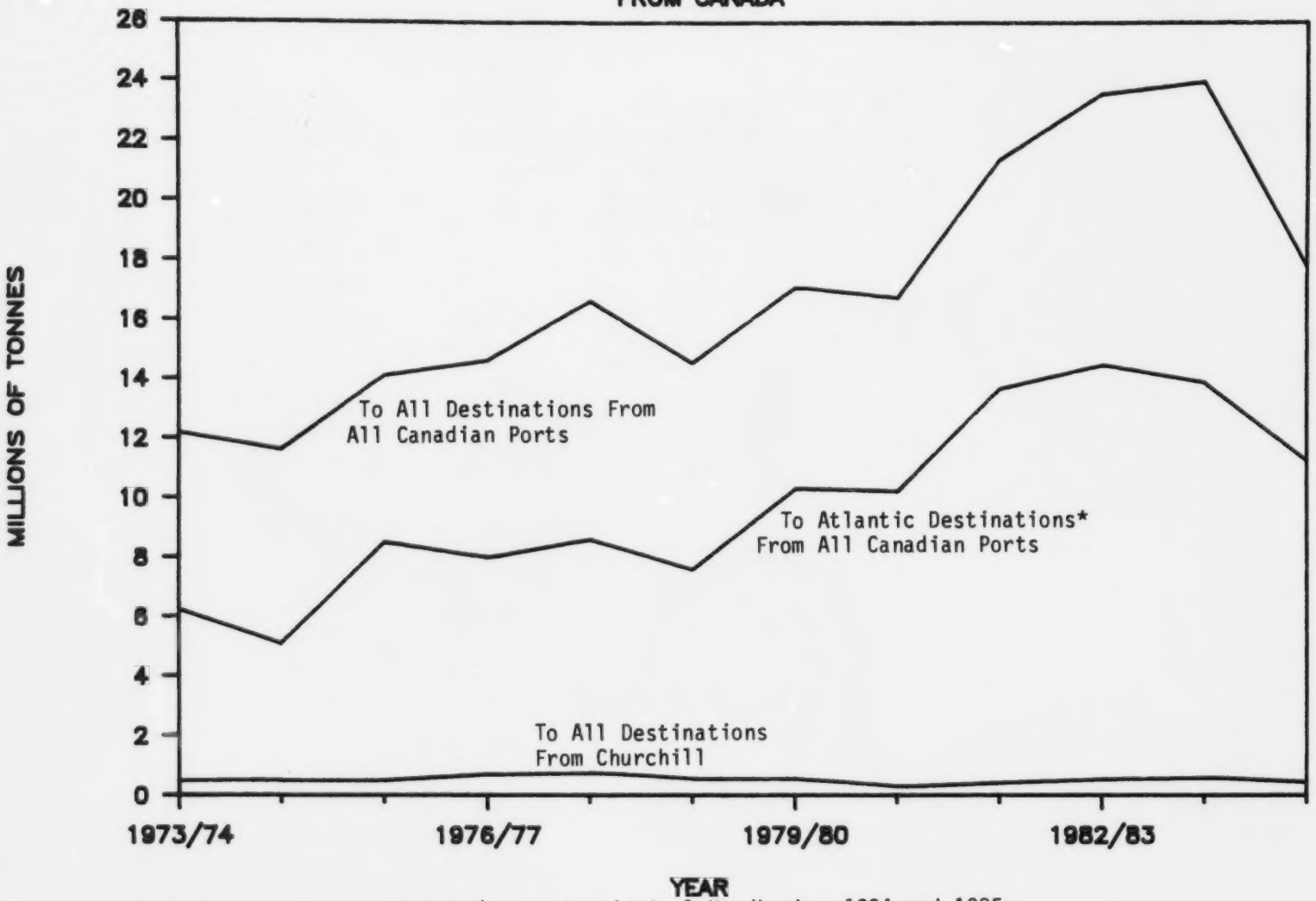
EXHIBIT 2.3

EXPORTS OF WHEAT AND BARLEY

FROM CANADA



Source: Canadian Grains Industry Statistical Handbook - 1984 and 1985

* Western and Eastern Europe, Western Africa, Eastern South America and the Caribbean

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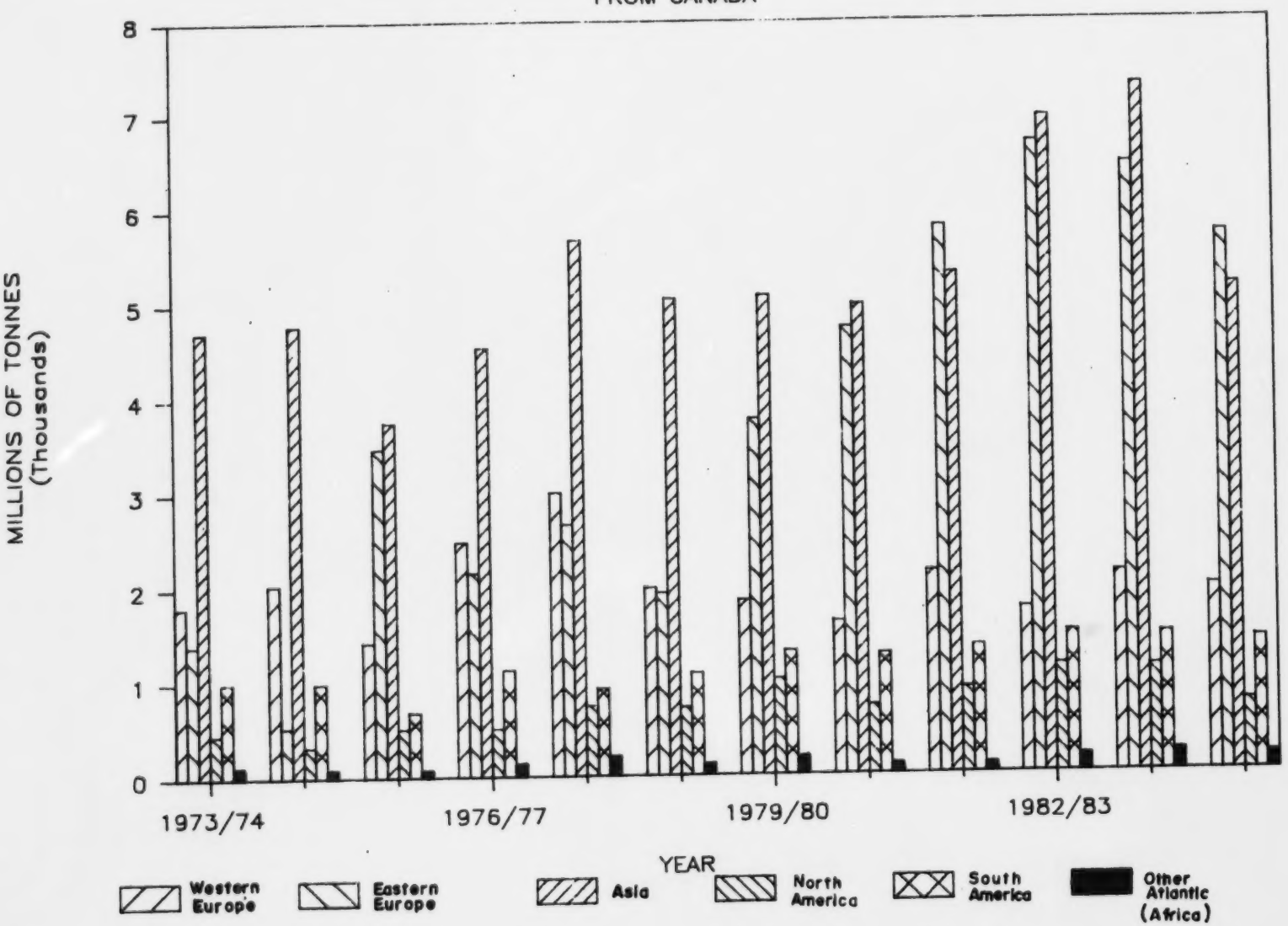
EXHIBIT 2.4

EXPORTS OF WHEAT

FROM CANADA



Source: Canadian Grains Industry Statistical Handbook - 1984 and 1985

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exports to Eastern Europe and the Mediterranean totalled close to 6,000,000 tonnes compared to 5,200,000 tonnes to Asia, 2,000,000 tonnes to Western Europe, 1,400,000 tonnes to South America, 800,000 tonnes to North America and the Caribbean, and 100,000 tonnes to African destinations on the Atlantic Ocean.

2.1.2 Wheat Exports by Grade

Exhibits 2.5 to 2.8 plot the patterns since 1973/74 of Canadian wheat exports by different grades.[1] While exports of 1 CWRS (Canada Western Red Spring) have been growing fairly steadily since 1975/76, both in total and to Atlantic destinations, exports of the lower grades have shown stronger fluctuations from year to year. The markets for these lower grades appear to be less stable than the markets for 1 CWRS. For example, exports of the grades 1 C.U. (Canada Utility) and Canada Feed, which are feed grades, reached about 2,000,000 tonnes in 1975 on the strength of a major sale to the U.S.S.R. In the following year, no feed wheat was exported to the U.S.S.R. and hence total exports of 1 C.U. and Canada Feed dropped to 740,000 tonnes.

2.1.3 Forecasts of Future Movements

Canadian grain exports are expected to continue growing in the future. Exhibit 2.9 contains forecasts of Canadian grain exports made by

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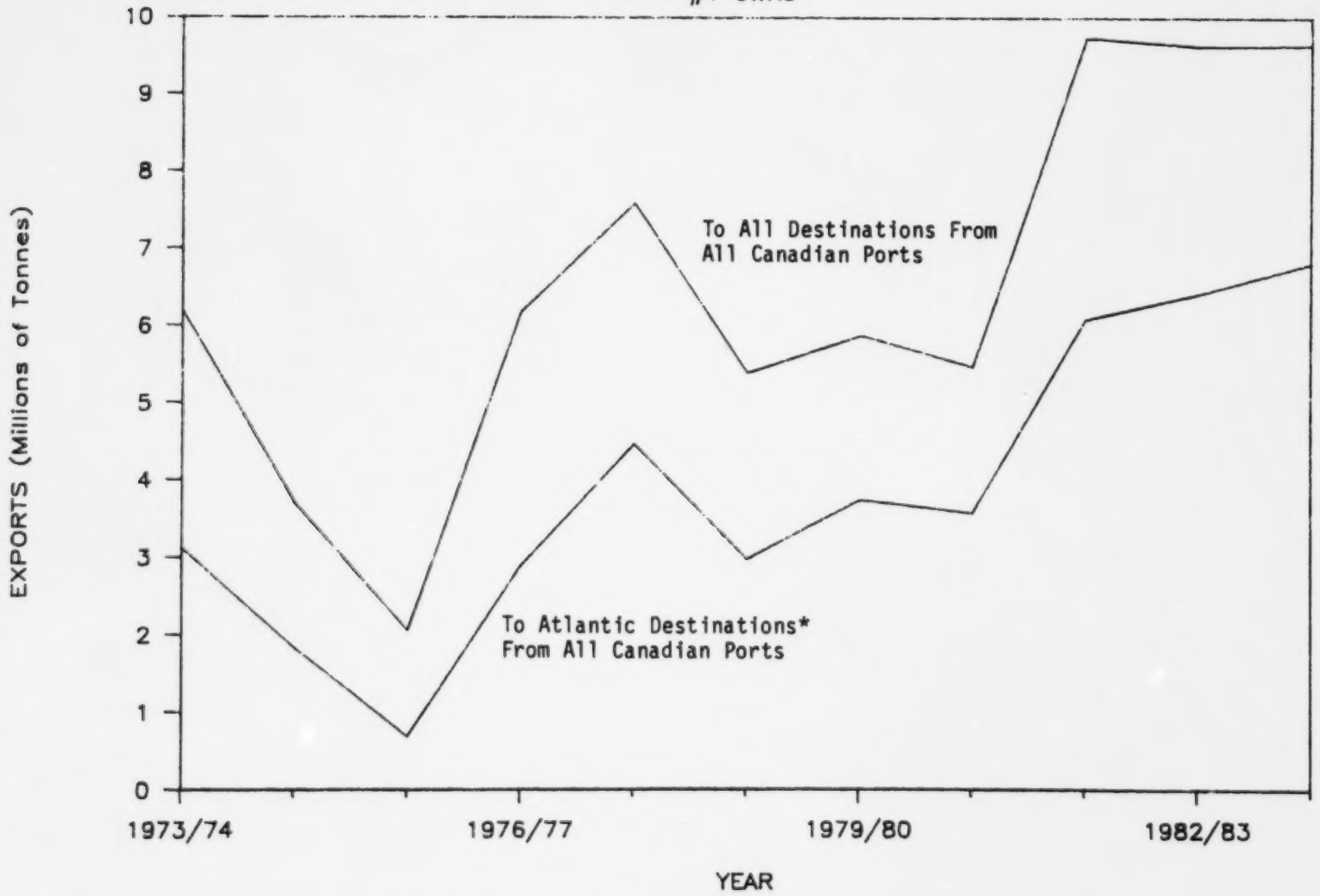
1. Canadian Prairie wheat is currently graded by number and, for the higher grades, by protein content. The grades 1, 2 and 3 CWRS (Canada Western Red Spring) are considered to be milling grades, although number 3 may be sold as feed. 1 CWRS is the highest grade. 1, 2 and 3 CWRS, along with the low quality feed grades 1 C.U. (Canada Utility) and Canada Feed, are differentiated according to density, specific varieties, general soundness (including degree of frost and heat damage), levels of admixtures (other grains and foreign materials), and other physical factors. 1 and 2 CWRS are further sub-graded by percent protein content, and buyers normally specify desired protein content ranges in their orders to the Wheat Board, with the higher protein contents commanding premium prices.

EXHIBIT 2.5

EXPORTS OF WHEAT

#1 CWRS



Source: Canadian Grain Industry Statistical Handbook - 1984 and 1985

* Western and Eastern Europe, Western Africa, Eastern South America and the Caribbean

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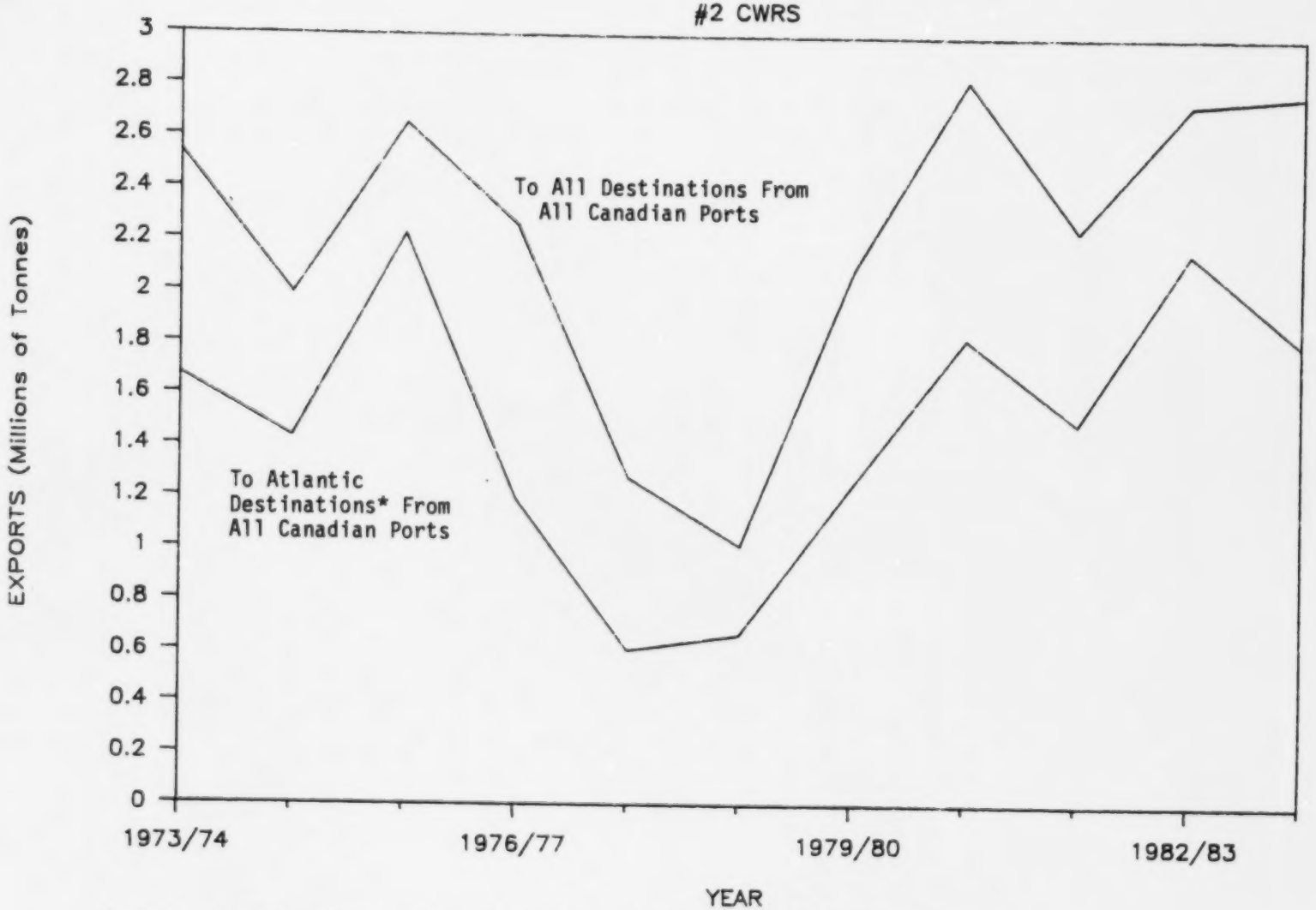
EXHIBIT 2.6

EXPORTS OF WHEAT

#2 CWRS



Source: Canadian Grain Industry Statistical Handbook - 1984 and 1985

* Western and Eastern Europe, Western Africa, Eastern South America and the Caribbean

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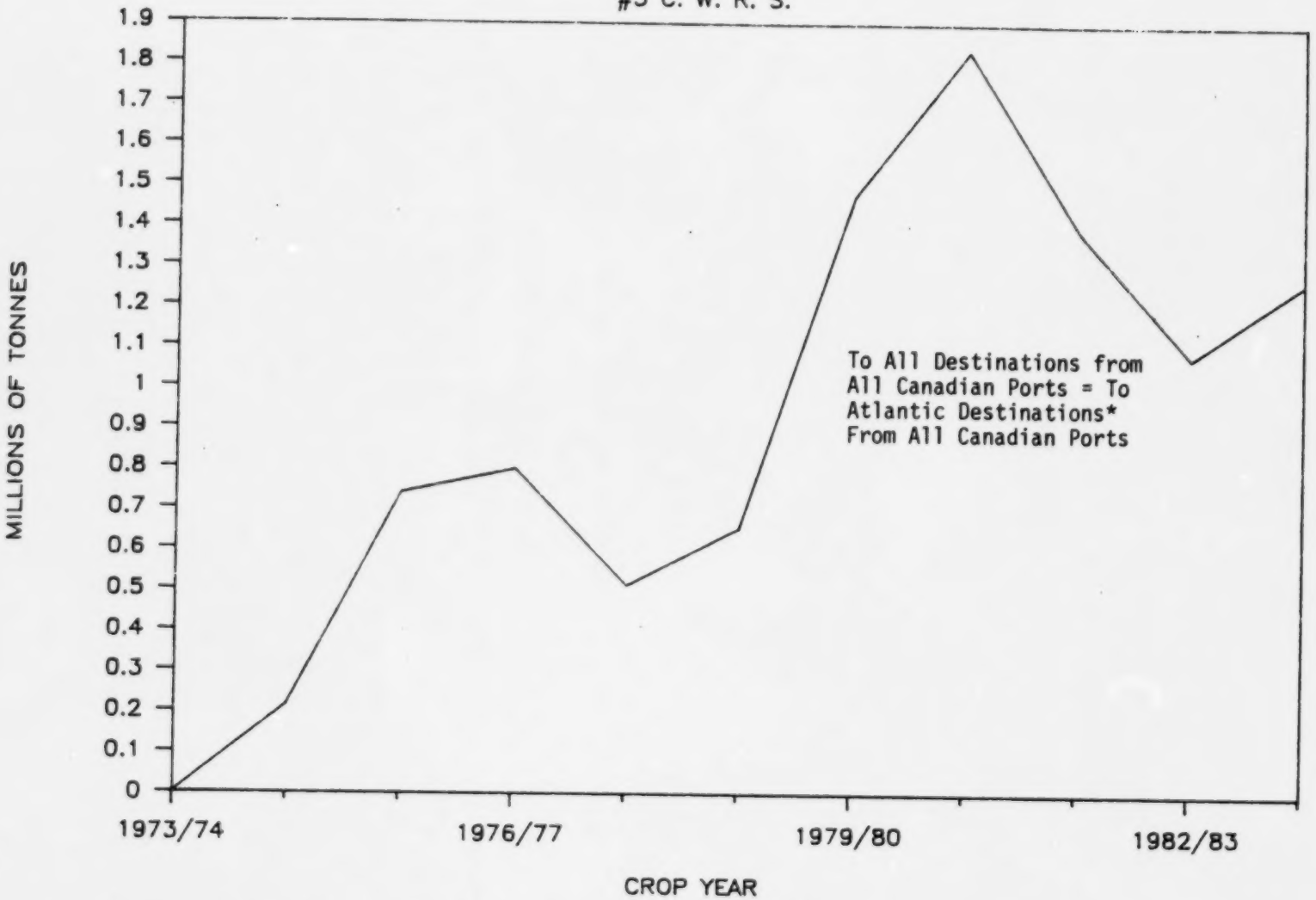
EXHIBIT 2.7

EXPORTS OF WHEAT

#3 C. W. R. S.



Source: Canadian Grains Industry Statistical Handbook - 1984 and 1985

* Western and Eastern Europe, Western Africa, Eastern South America and the Caribbean

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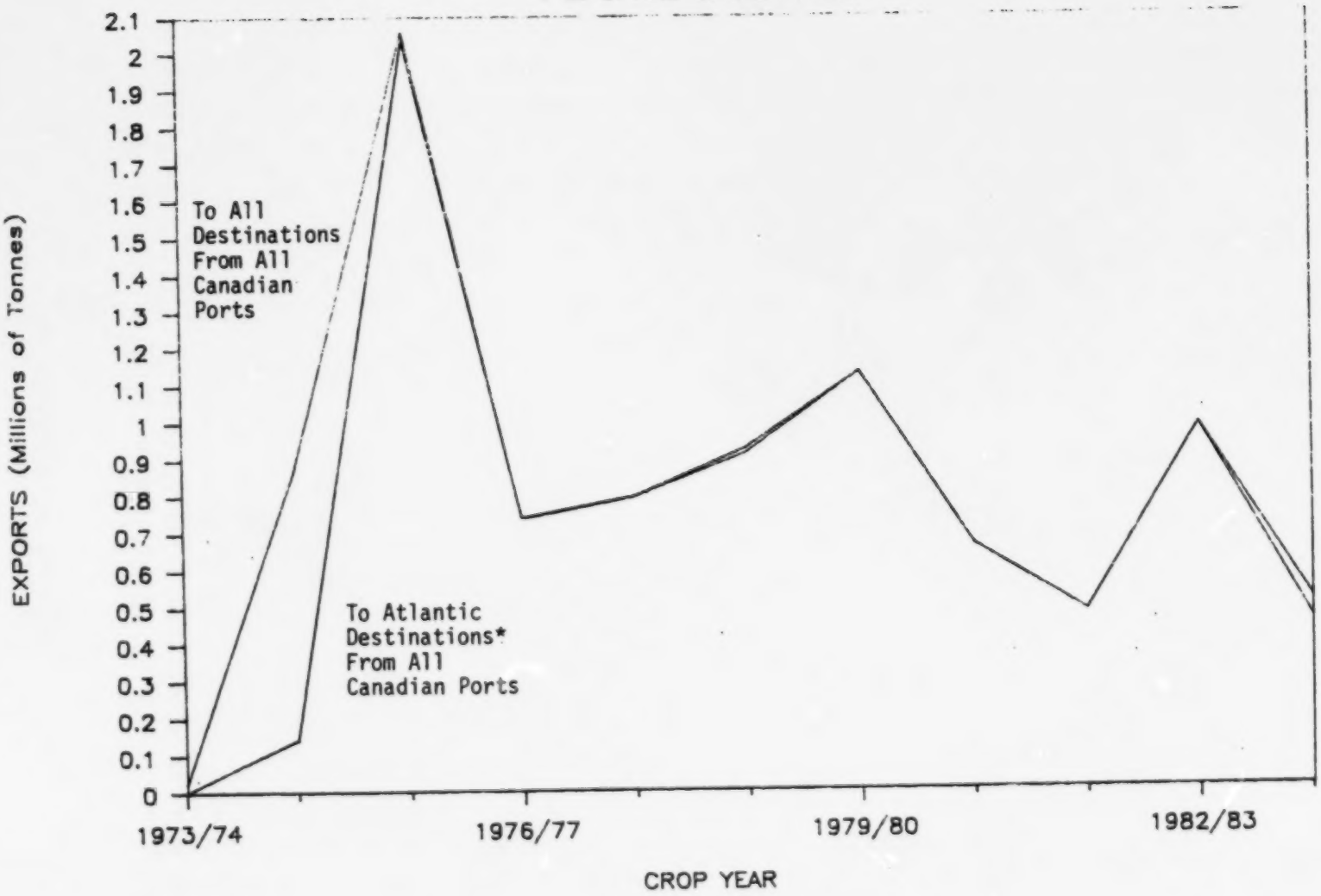
EXHIBIT 2.8

EXPORTS OF WHEAT

1 C. U. AND CANADA FEED



Source: Canadian Grains Industry Statistical Handbook - 1984 and 1985

* Western and Eastern Europe, Western Africa, Eastern South America and the Caribbean

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EXHIBIT 2.9

FORECASTS OF TOTAL CANADIAN GRAIN EXPORTS IN 1990/91

(Millions of Tonnes)

AGENCY

Grain Transportation Authority[1]

Trend Line Forecast	System Design Parameters*		Trend Line Forecast Pro-rated by System Design Parameters Shares	
Total 26.6	Through Thunder Bay**	14.8	Through Thunder Bay**	12.3
	Through West Coast***	16.5	Through West Coast	13.6
	Through Churchill	0.8	Through Churchill	0.7
	Total	32.1	Total	26.6

Canada Grains Council[2]

Through Thunder Bay**	17.4
Through West Coast	12.6
Through Churchill	0.9
Total	30.9

Average (of GTA trend line and CGC Forecasts) = 28.8

* Higher-than-average forecast to reflect potential volumes in a peak crop year.

** Direct overseas and with transshipment at lower St. Lawrence ports.

*** Would require expanded capacity at West Coast terminals (Prince Rupert and/or Vancouver)

1. Grain Transportation Authority, System Design Parameters and Rail Car Requirements to 1991, April, 1983.

2. Canada Grains Council, Prospects for the Prairie Grain Industry 1990, November, 1982.

the Grain Transportation Authority (now the Grain Transportation Agency) and the Canada Grains Council. The Grain Transportation Authority forecast is based on a trend line analysis of Prairie grain production and domestic grain consumption while the Canada Grains Council forecast is based on projected changes to 1990 in Prairie crop yields, the amount of land in production and the amount of land allocated to summerfallow. The average forecast for total exports in 1990/91 is 28.8 million tonnes, which would be a 31 percent increase over the 1984/85 export volume of 21,995,000 tonnes and only two percent less than the record 1983/84 total of 29,440,000 tonnes. The average forecasts predict increases in export grain throughputs at each of Thunder Bay, the West Coast and Churchill, to 14.9 million, 13.1 million and 0.8 million tonnes per year respectively. The average annual volumes of grain exported via Thunder Bay, the West Coast and Churchill between 1980/81 and 1984/85 were 13.50, 11.16 and 0.47 million tonnes respectively. Therefore, the forecasts imply increases in export grain throughputs of 10 percent at Thunder Bay, 17 percent at the West Coast and 70 percent at Churchill in 1990/91 compared to the 1980/81 to 1984/85 average volumes. Based on these forecasts, it would appear that even if grain exports through Churchill were substantially increased over current levels, throughputs at the West Coast and at Thunder Bay in 1990/91 would also be significantly higher than current levels.

2.2 GRAIN EXPORTS THROUGH CHURCHILL

Exhibit 2.10 gives the exports of grain (including wheat, barley, screenings and pellets) through the Port of Churchill from 1950 through 1985. Exhibit 2.11 plots this data for total grain exports against time, while separate plots for wheat and barley exports are presented in Appendix A. It is seen that total grain exports through Churchill levelled off in the mid 1960's and have not been growing since then. As a percentage of all Prairie grain exports, shipments from Churchill have declined from 3.8 percent of the total in 1970/71 to 2.0 percent in 1984/85. Since 1971, the grain volumes through Churchill have exhibited greater fluctuations from year to year than was the case through the 1960's. The largest annual

EXHIBIT 2.10

CHURCHILL EXPORT GRAIN SHIPMENTS: 1950 - 1985

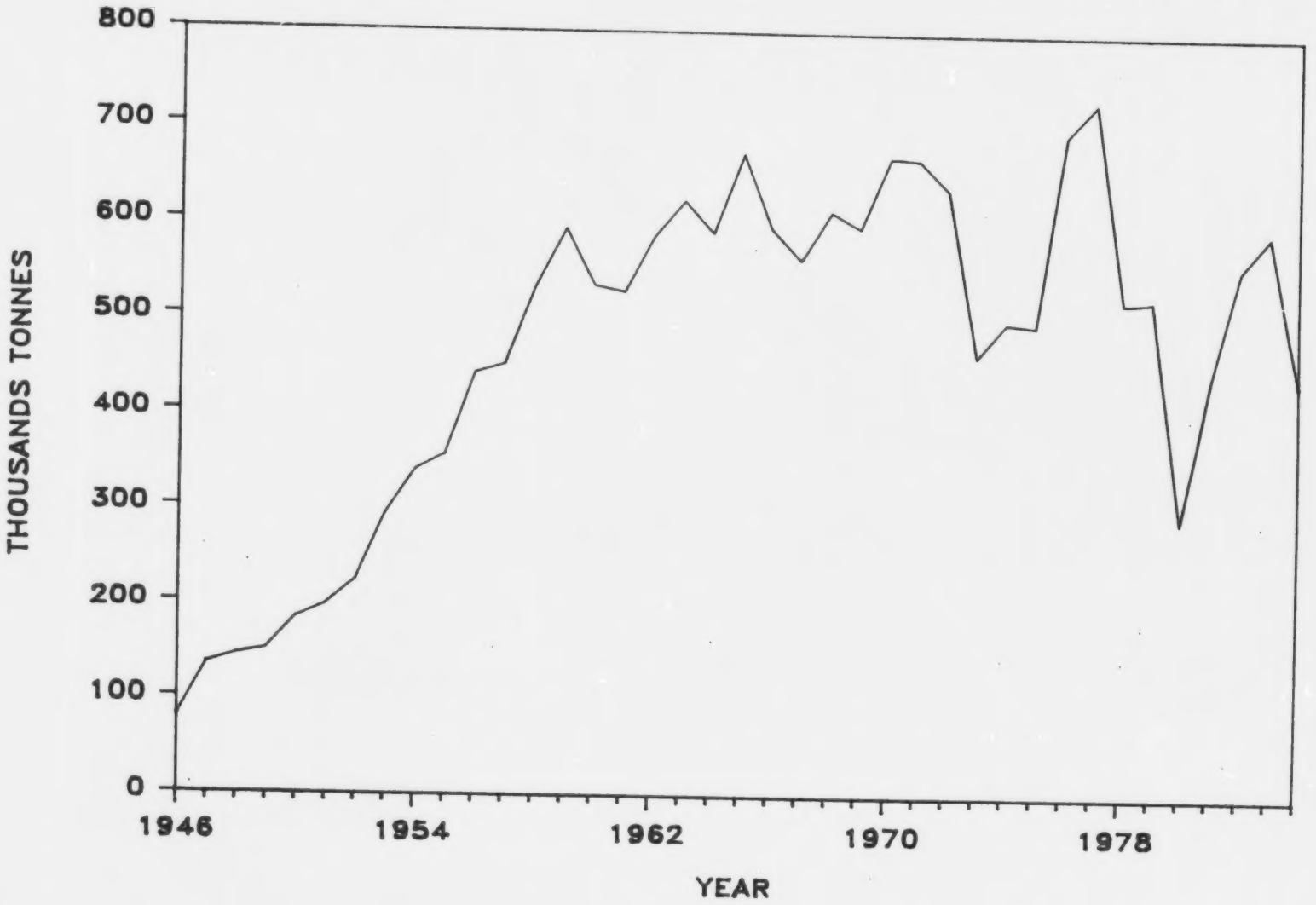
(Thousands of Tonnes)

Calendar Year	No. of Ships	Wheat	Barley	Screenings and Pellets	Total
1985	13	236.0	123.0	-	359.0
1984	15	428.0	8.0	-	436.0
1983	22	22.0	599.0	-	621.0
1982	18	389.0	168.0	11.9	568.9
1981	16	294.0	144.0	14.1	452.1
1980	12	280.3	9.5	19.0	308.8
1979	20	-	522.6	13.9	536.5
1978	20	69.1	450.3	23.3	542.7
1977	34	709.9	19.3	26.0	755.2
1976	27	383.3	311.5	24.3	719.1
1975	21	-	494.4	11.8	506.2
1974	20	15.0	483.0	-	498.0
1973	-	265.0	197.0	-	462.0
1972	30	443.0	192.8	-	635.8
1971	37	559.8	107.1	-	666.9
1970	35	669.9	-	-	669.9
1969	28	595.3	-	-	595.3
1968	34	612.8	-	-	612.8
1967	33	561.7	-	-	561.7
1966	40	593.8	-	-	593.8
1965	45	672.4	-	-	672.4
1964	41	589.1	-	-	589.1
1963	48	622.3	-	-	622.3
1962	49	585.8	-	-	585.8
1961	48	526.6	-	-	526.6
1960	48	532.9	-	-	532.9
1959	58	592.9	-	-	592.9
1958	55	533.4	-	-	533.4
1957	46	451.1	-	-	451.1
1956	48	442.2	-	-	442.2
1955	38	355.9	-	-	355.9
1954	36	339.8	-	-	339.8
1953	31	293.5	-	-	293.5
1952	26	223.6	-	-	223.6
1951	21	198.1	-	-	198.1
1950	20	184.2	-	-	184.2

SOURCE: National Harbours Board, Annual Traffic Reports, 1950 - 1980; and Port of Churchill Records

EXHIBIT 2.11

CHURCHILL TOTAL GRAIN SHIPMENTS



Source: National Harbours Board, Annual Traffic Reports, 1946-1980
and Port of Churchill Records

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volume (including wheat, barley, screenings and pellets) has been 755,000 tonnes which occurred in 1977. Barley was shipped through Churchill for the first time in 1971, and since then has alternated with wheat as the major grain shipped through the Port. In most years since 1971, the practice of the Canadian Wheat Board (CWB) has been to ship either wheat or barley almost exclusively in a given year through Churchill.

2.2.1 Destination of Churchill Exports

Exhibits 2.12 and 2.13 provide summary information on the destinations of grain exported through Churchill for the two periods 1960-1973 and 1974-1985. More detailed information on shipment volumes to the different individual nations and their geographical groupings for each year since 1960 is provided in Appendix A. During the period 1960-1973, the United Kingdom was by far the predominant destination for grain from Churchill. On average during this period, 54% of the grain went to the United Kingdom and 88% to Western Europe in total, with only 6.6% accounted for by Eastern European nations. Starting in 1973, there was a major shift in the pattern of destinations for grain shipped through Churchill in favour of Eastern European destinations (Poland and the U.S.S.R., in particular). During the period from 1974 to 1985, 56% of the Churchill grain was shipped to Eastern Europe compared to 24% shipped to Western Europe. There was also a significant increase in the proportion of grain going to Mediterranean and Persian Gulf destinations (from 3.7% in 1960-1973 to 15.8% in 1974-1985).

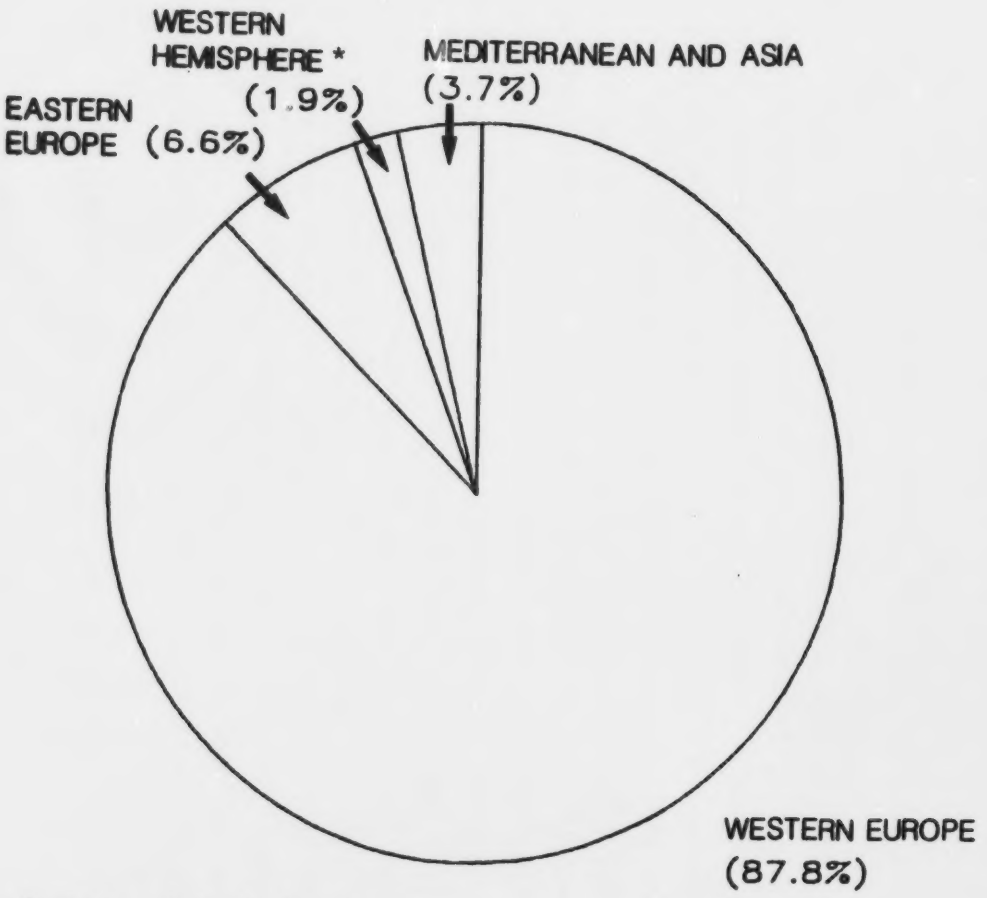
2.2.2 Changes in Grades Shipped Through Churchill

This shift in destinations, as well as the shift to using barley shipments to supplement wheat shipments throughout Churchill, was caused in part by the full implementation in 1972 of the current grading system for wheat, which for 1 CWRS and 2 CWRS is based on protein content. Due to a general lack of protein grading equipment and insufficient numbers of bins at primary elevators, it has not been practical to segregate wheat by

EXHIBIT 2.12

DESTINATIONS OF GRAIN FROM CHURCHILL

1960/61 TO 1973/74



* Caribbean, Central and South America

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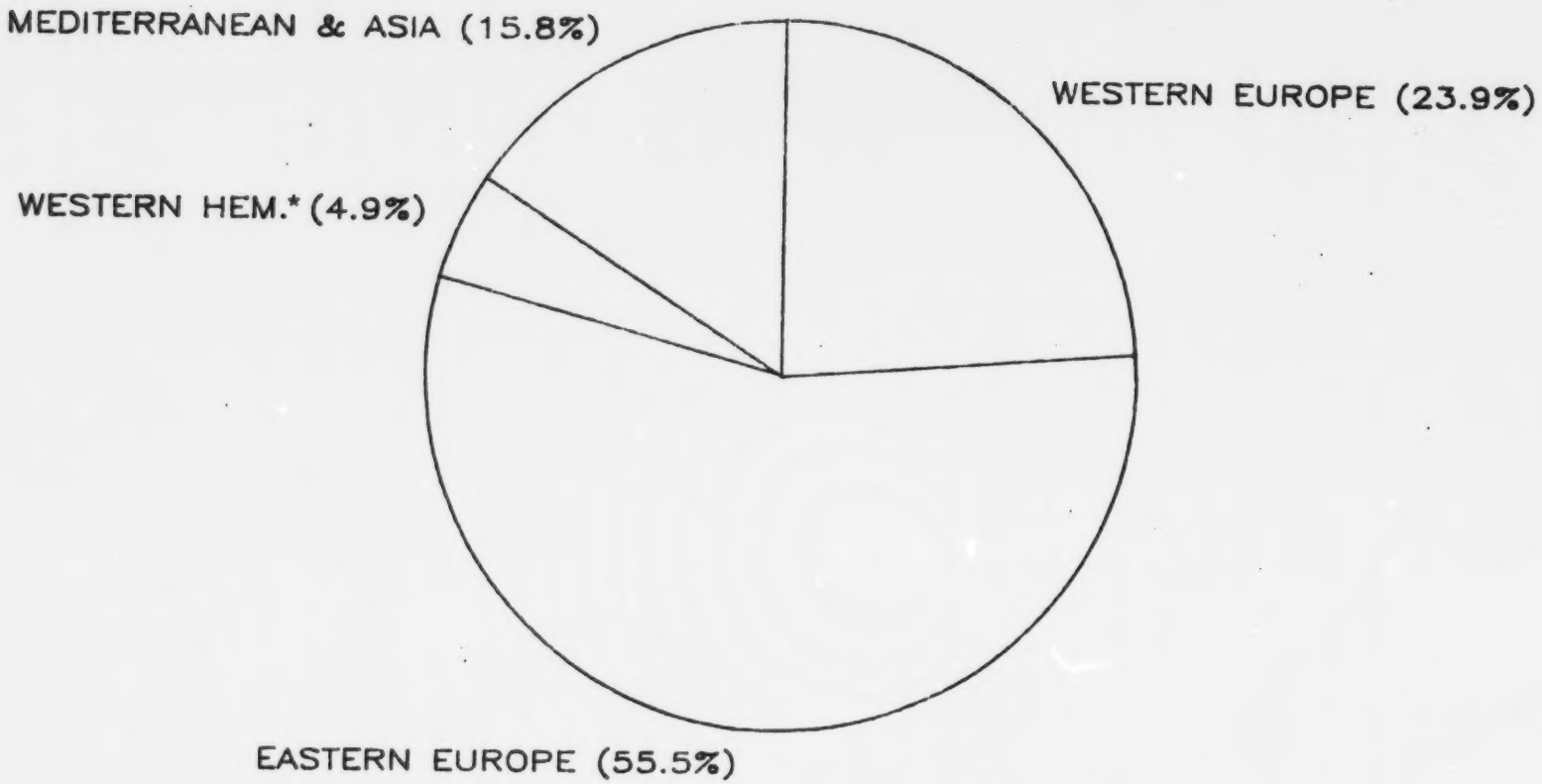
EXHIBIT 2.13

DESTINATION OF GRAIN FROM CHURCHILL

1974/75 TO 1985/86



* Caribbean, Central and South America

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protein content in the primary elevator system. Because of this, the switch to protein grading has made it more difficult for the Canadian Wheat Board to market high grade, high protein wheat through Churchill. That is, in shipping high grade wheat to Churchill, the CWB runs the risk that when the wheat is protein graded at the Port the percentage protein content might not match the customer's specifications and, because of the limited volume of movement through Churchill and the limited shipping season, the CWB may find it difficult to fill the order on time and to dispose of the mismatched grades at the going price (to avoid carrying them through the winter).

Since 1973, Churchill has handled primarily lower grade wheat (2 CWRS, 3 CWRS and feed grades) and barley, going mainly to Eastern Europe. It should be noted, however, that significant volumes of 1 CWRS wheat have moved through Churchill in certain years, possibly partly due to shortages of the lower grades in the areas of Northwestern Manitoba and North Central Saskatchewan which historically have provided most of the grain shipped through Churchill (the geographical sources of rail shipments of grain to Churchill are examined in more detail in Chapter 3). Exhibit 2.14 gives the distribution by grade of the wheat shipped through Churchill between 1980 and 1983.

It should be noted from Appendix A that there were no exports of grain through Churchill to Poland in 1984 and 1985. An average of 209,000 tonnes of grain per year were shipped from Churchill to Poland in the period 1974-1983. The loss of Poland as a major customer for Canadian export grain, due mainly to credit restrictions placed on the nation, is therefore likely to have a negative impact on the volume of grain shipped through Churchill until Poland regains credit and resumes its imports from Canada.

2.2.3 Barley Exports

Exhibit 2.15 gives the destinations of Canadian barley exports in 1983 from the various export terminal ports. It can be seen that all the

EXHIBIT 2.14

CHURCHILL WHEAT EXPORTS BY GRADE
(Tonnes)

YEAR	GRADE							
	1 CWRS 13.5% PROTEIN	1 CWRS 12.5% PROTEIN	TOTAL 1 CWRS	2 CWRS 13.5% PROTEIN	2 CWRS 12.5% PROTEIN	TOTAL 2 CWRS	3 CWRS	TOTAL
1983/84								
Italy	7,064	5,423	12,487	6,097	3,729	9,826	-	22,313
1982/83								
Poland	201,846	43,450	245,296	73,964	61,410	135,374	8,035	388,705
1981/82								
Poland	-	-	-	-	147,140	147,140	146,860	294,000
1980/81								
Poland								185,498
U.S.S.R.								69,553
Italy								24,941
TOTAL	-	43,458	43,458	-	119,147	119,147	117,387	279,992

SOURCE: Canadian Grain Commission, Canadian Grain Exports

EXHIBIT 2.15

TOTAL CANADIAN INTERNATIONAL TRADE IN BARLEY, 1983

PORT	TONNES
CHURCHILL	
FRANCE	21 600
BELGIUM-LUXEMB.	267 685
USSR	44 440
ROMANIA	66 500
GERMANY EAST	62 842
POLAND	409 595
CYPRUS	25 700
TOTAL HANDLING PORT	598 362
HALIFAX	
BELGIUM-LUXEMB.	31 500
GERMANY WEST	- -
UNITED KINGDOM	- -
ISRAEL	31 230
KUWAIT	26 250
CUBA	700
TRINIDAD-TOBAGO	10
TOTAL HANDLING PORT	89 691
SAINT JOHN	
CUBA	6 081
TOTAL HANDLING PORT	6 081
BAIE COMEAU	
SPAIN	89 653
ITALY	44 776
BELGIUM-LUXEMB.	52 500
NETHERLANDS	47 250
USSR	87 579
BLACK SEA NES	29 307
GERMANY EAST	363 721
POLAND	22 500
ISRAEL	140 200
IRAN	31 500
JORDAN	4 446
KUWAIT	5 536
US GREAT LAKES	10 675
TOTAL HANDLING PORT	929 645

PORT	TONNES
MONTREAL	
BELGIUM-LUXEMB.	59 221
USSR	36 331
BLACK SEA NES	21 559
GERMANY EAST	60 795
TURKEY	20 362
IRAN	26 250
JORDAN	26 250
CUBA	28 753
TOTAL HANDLING PORT	279 521
PORT CARTIER	
SPAIN	79 314
BELGIUM-LUXEMB.	78 914
BLACK SEA NES	2 868
ISRAEL	27 026
TOTAL HANDLING PORT	188 125
QUEBEC	
SPAIN	203 607
BELGIUM-LUXEMB.	174 938
SWEDEN	50 675
USSR	24 084
GERMANY EAST	350 860
CYPRUS	20 460
TURKEY	31 500
IRAN	150 934
KUWAIT	76 517
TOTAL HANDLING PORT	1 083 576
SOREL	
BALTIC SEA NES	15 172
TURKEY	33 000
CUBA	5 391
TOTAL HANDLING PORT	53 563
TROIS-RIVIERES	
USSR	24 990
TURKEY	64 250
JORDAN	3 500
US GREAT LAKES	64 981
TOTAL HANDLING PORT	159 721

PORT	TONNES
GODERICH	
US GREAT LAKES	14 000
TOTAL HANDLING PORT	14 000
THUNDER BAY	
BELGIUM-LUXEMB.	52 546
GERMANY WEST	20 065
NETHERLANDS	19 739
GERMANY EAST	19 300
COLOMBIA	97 091
PERU	10 500
TOTAL HANDLING PORT	219 241
PRINCE RUPERT	
JAPAN	3 517
KOREA SOUTH	7 082
TOTAL HANDLING PORT	10 599
VANCOUVER	
ITALY	177 256
GERMANY WEST	51 116
USSR	592 020
IRAN	60 522
MALAYSIA	36
JAPAN	1 034 050
PEOPLE R CHINA	82 725
TAIWAN	52 500
COLOMBIA	20 942
PERU	5 250
MEXICO	84 811
US HAWAII	4 996
TOTAL HANDLING PORT	2 466 224
TOTAL COMMODITY	5 798 350

Source: Statistics Canada, Catalogue 54-209, International Seaborne Shipping Commodity Statistics, 1983

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barley moving through Churchill was going to Atlantic destinations (including Baltic and Mediterranean). Similarly, almost all the barley going through Thunder Bay and the St. Lawrence ports was destined for Atlantic destinations plus some shipments to the Persian Gulf ports; the only exception was one shipment from Thunder Bay to Peru. By contrast, Vancouver showed a preponderance of movements to Pacific destinations, although there were some shipments to Atlantic destinations (Italy in particular). This suggests that Churchill and the St. Lawrence route were serving similar destinations for barley exports in this period.

2.2.4 Role of Churchill

Overall, Churchill has been a minor port relative to Thunder Bay and Vancouver and since 1973 has shipped predominantly barley and low grade wheat to Eastern Europe. As discussed in section 2.1, the most significant market area now served by Churchill, namely Eastern Europe and the Mediterranean, is an area in which there has been good market growth for Canadian grain exports over the past decade. However, markets for barley and low grade wheat appear to have been more variable than the market for high grade wheat, and this may partially explain why Churchill export volumes have shown considerable fluctuations from year to year over the past decade.

2.3 RECEIPTS AT TERMINAL ELEVATORS

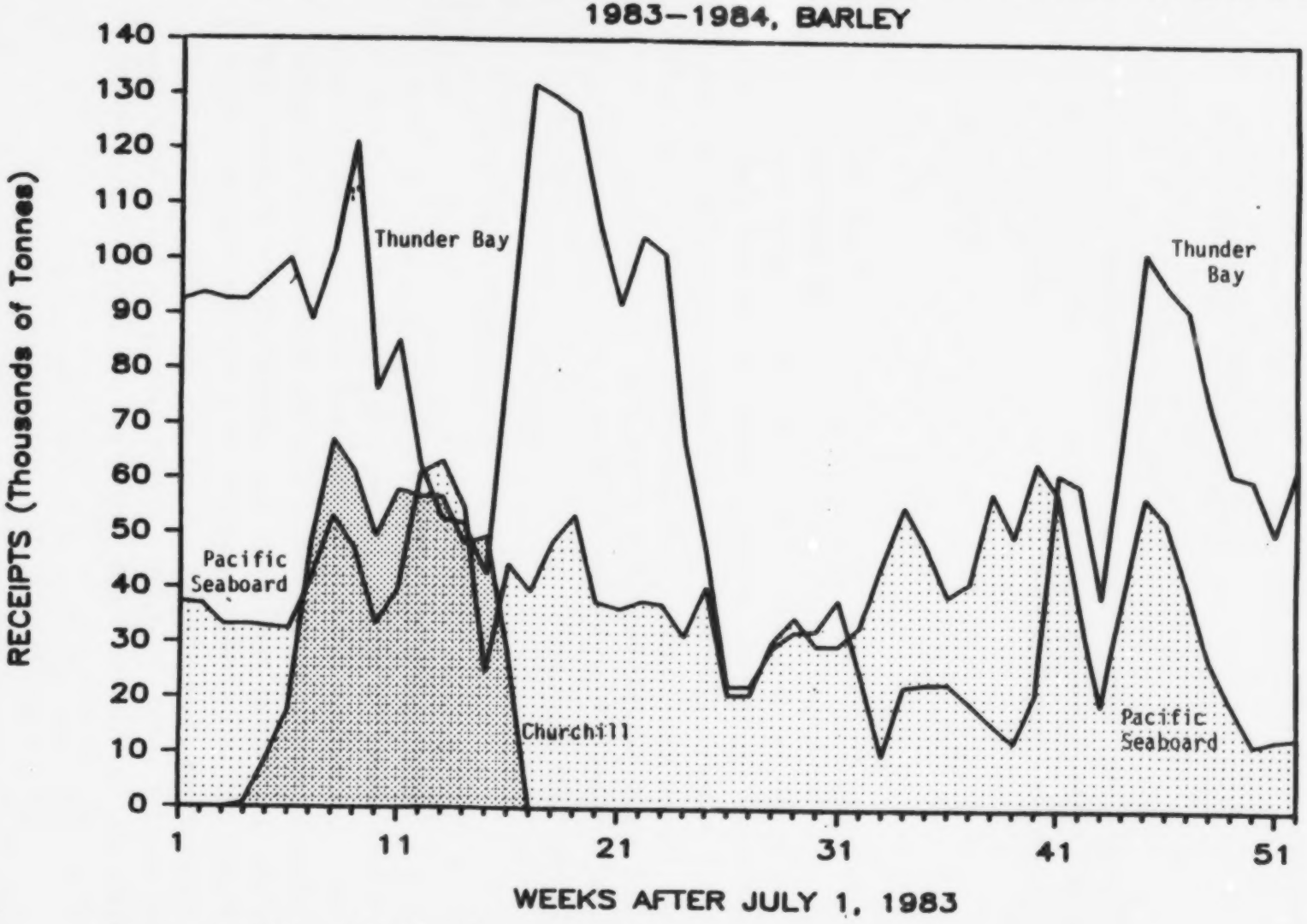
To examine the interactions of grain flow levels at Churchill and other export grain terminals, we have studied the weekly receipts of Board grains (wheat, barley and oats) at Churchill, Thunder Bay and the West Coast.

2.3.1 Weekly Distribution of Flows

Exhibit 2.16 shows the total amounts of Board grain received each week at these terminals during 1983/1984, a record year for grain exports.

EXHIBIT 2.17

WEEKLY RECEIPTS AT TERMINAL POINTS



Source: Canadian Grain Commission, Weekly Grain Statistics

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Instead of showing these receipts in a normal pattern from the beginning of the grain industry crop year set at August 1, we have shown receipts starting from the beginning of July so that all Churchill receipts in one shipping season are shown on the same cycle. It is seen again in Exhibit 2.16 that Churchill receives only a very minor portion of the total shipments of Prairie export grain.

Exhibit 2.17 shows barley receipts for the same period. In 1983, Churchill shipped barley almost exclusively (571,000 tonnes of barley and 22,000 tonnes of wheat for a total throughput of 593,000 tonnes). It can be seen from this Exhibit that, during the Churchill shipping season, receipts at Thunder Bay were reduced while those at the West Coast were not. Effectively, during the Churchill shipping season, receipts of barley at Churchill equalled those at Thunder Bay.

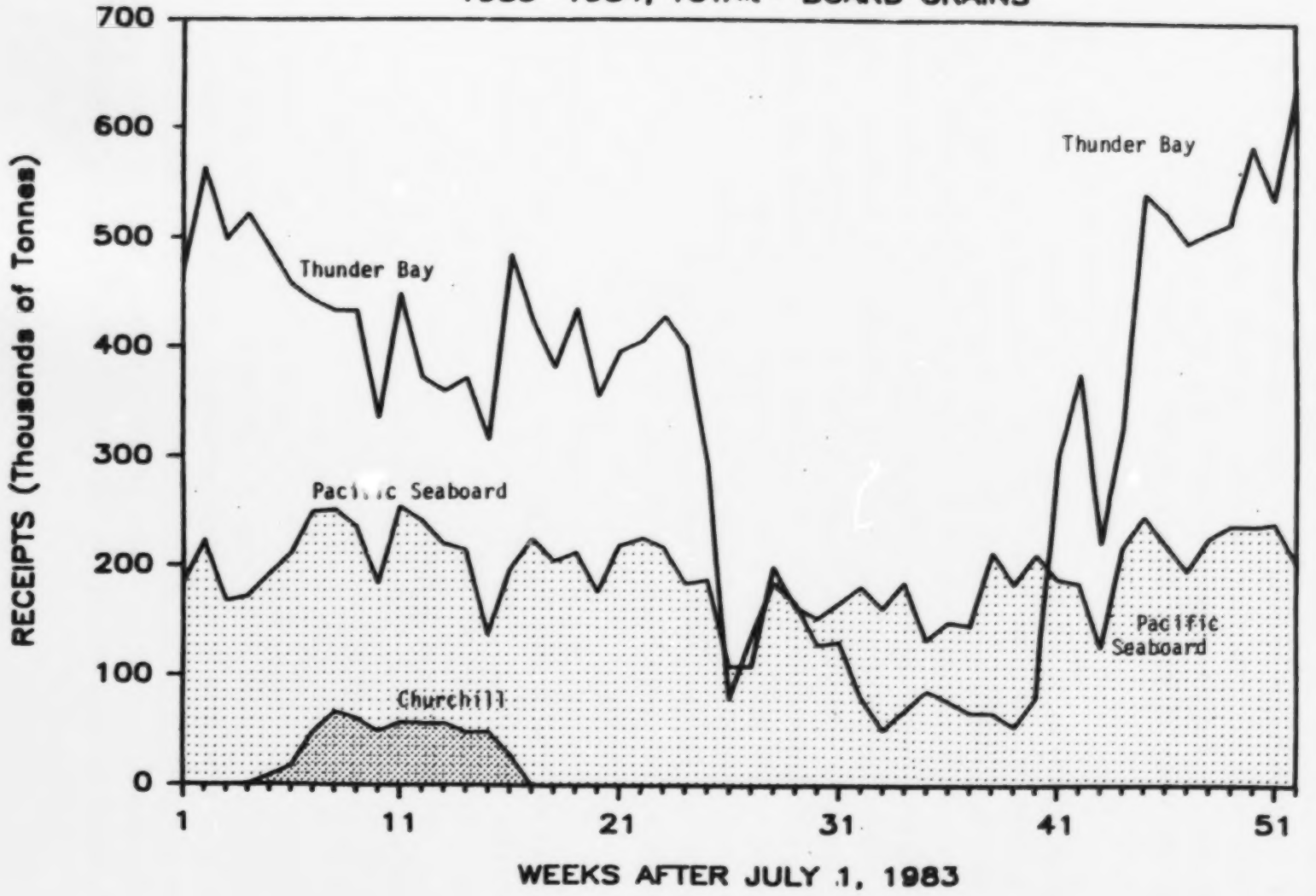
In 1982, significant volumes of both wheat and barley were exported through Churchill (389,000 tonnes of wheat and 168,000 tonnes of barley). Exhibits 2.18, 2.19 and 2.20 respectively present the weekly receipts of total Board grains, wheat and barley at the various terminal points for 1982-83. The interaction of flows through Churchill and Thunder Bay is again evident, with larger flows through Thunder Bay before and after the Churchill season than during it. This is especially apparent for barley, which is a smaller crop than wheat. It also appears from Exhibits 2.18 to 2.20 that receipts at the West Coast terminals fell somewhat towards the end of the Churchill shipping season. However, the very low level of receipts observed at the West Coast terminals for week 18 (in early November) suggests that the drop-off was due to an unusual disturbance in shipments through the West Coast.

In 1984, Churchill handled 428,000 tonnes of wheat and 8,000 tonnes of barley. Exhibit 2.21 shows the weekly receipts of total Board grains at the various terminal points for 1984/1985. In this case, the interaction of Thunder Bay with Churchill is less noticeable, but still evident. Unlike other years, receipts at Thunder Bay did not rise after Churchill closed due to the unusually poor harvest in the fall of 1984.

EXHIBIT 2.16

WEEKLY RECEIPTS AT TERMINAL POINTS

1983–1984, TOTAL - BOARD GRAINS



Source: Canadian Grain Commission, Weekly Grain Statistics

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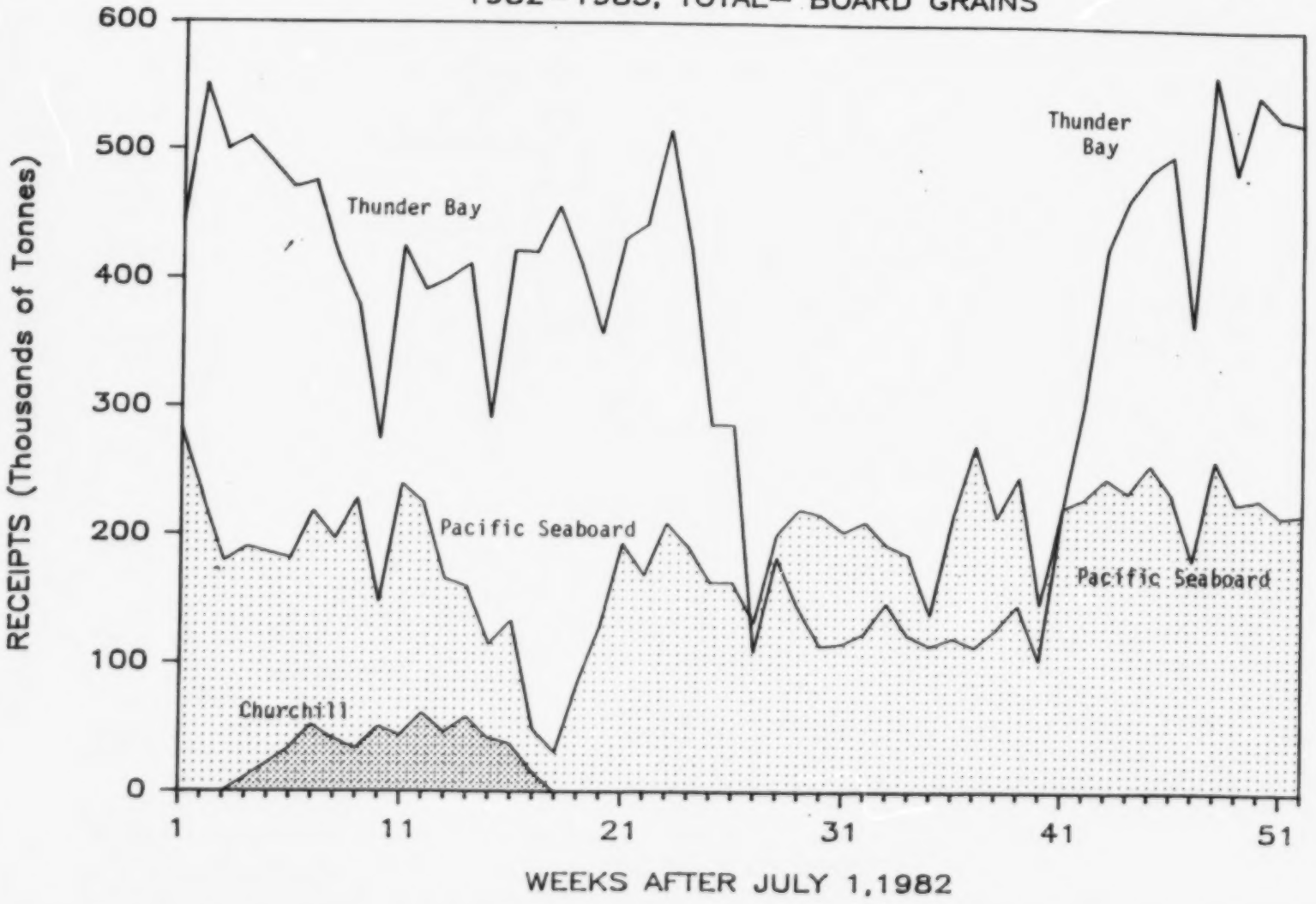
EXHIBIT 2.18

WEEKLY RECEIPTS AT TERMINAL POINTS

1982–1983, TOTAL– BOARD GRAINS



Source: Canadian Grain Commission, Weekly Grain Statistics

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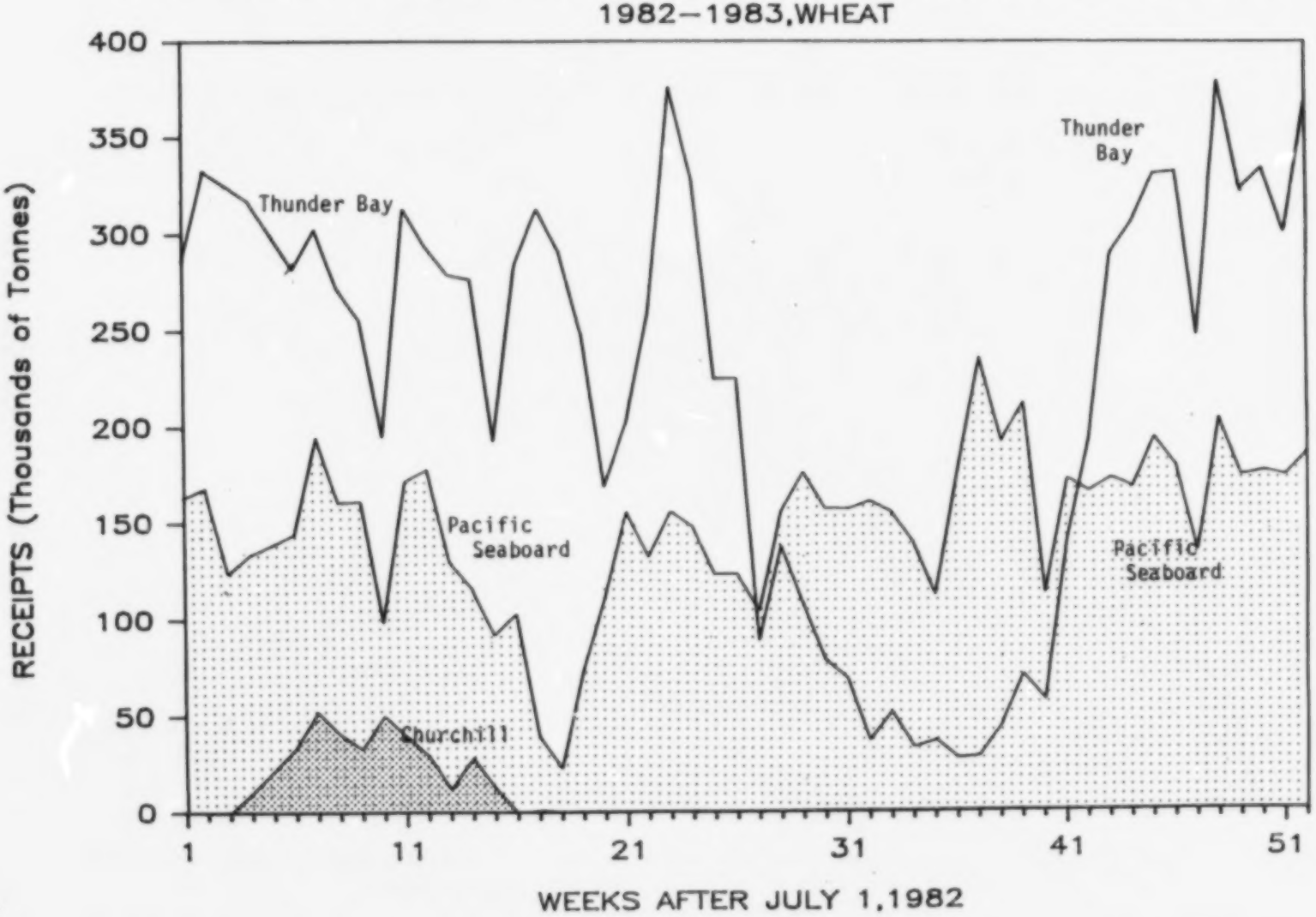
EXHIBIT 2.19

WEEKLY RECEIPTS AT TERMINAL POINTS



Source: Canadian Grain Commission, Weekly Grain Statistics

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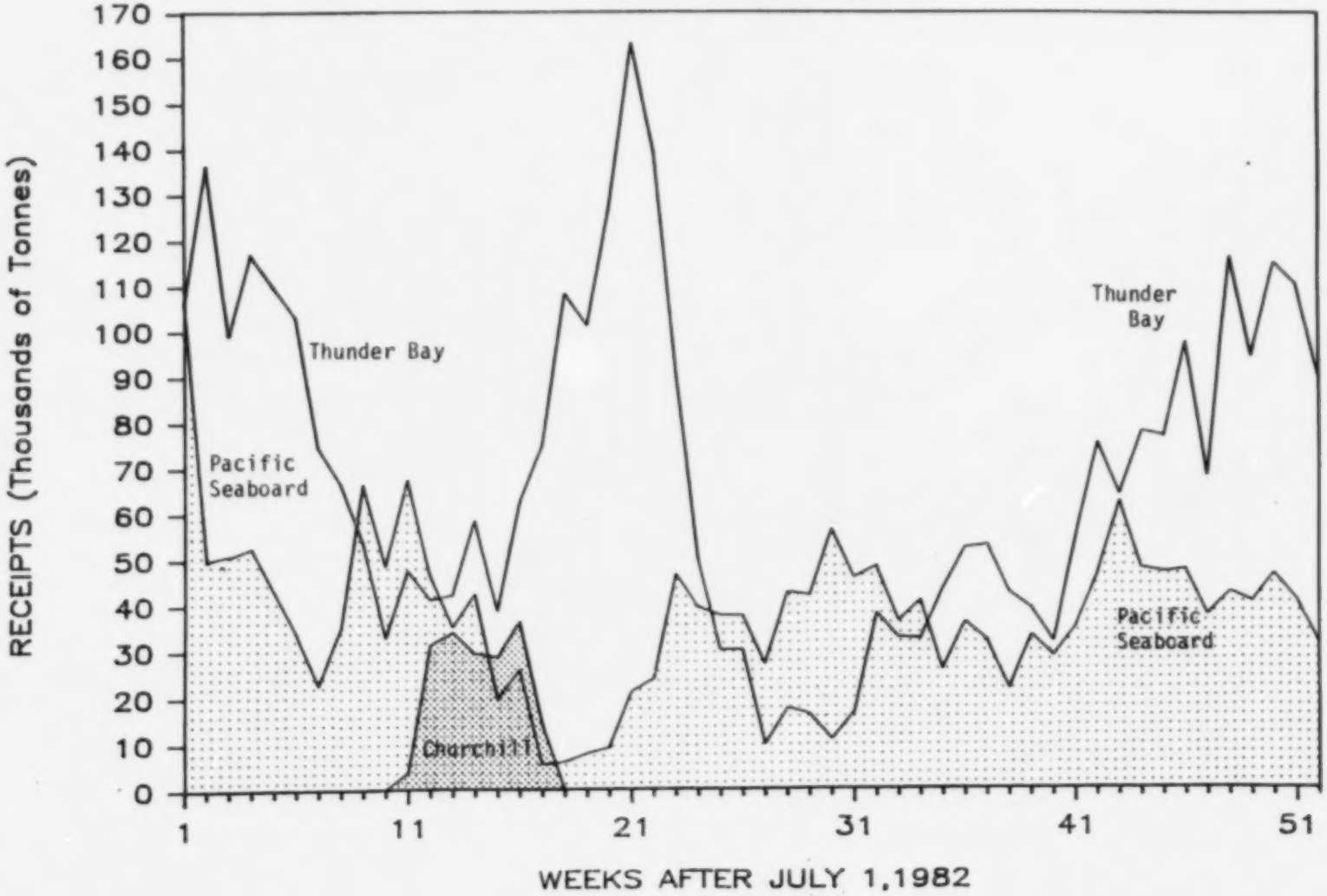
EXHIBIT 2.20

WEEKLY RECEIPTS AT TERMINAL POINTS

1982–1983, BARLEY



Source: Canadian Grain Commission, Weekly Grain Statistics

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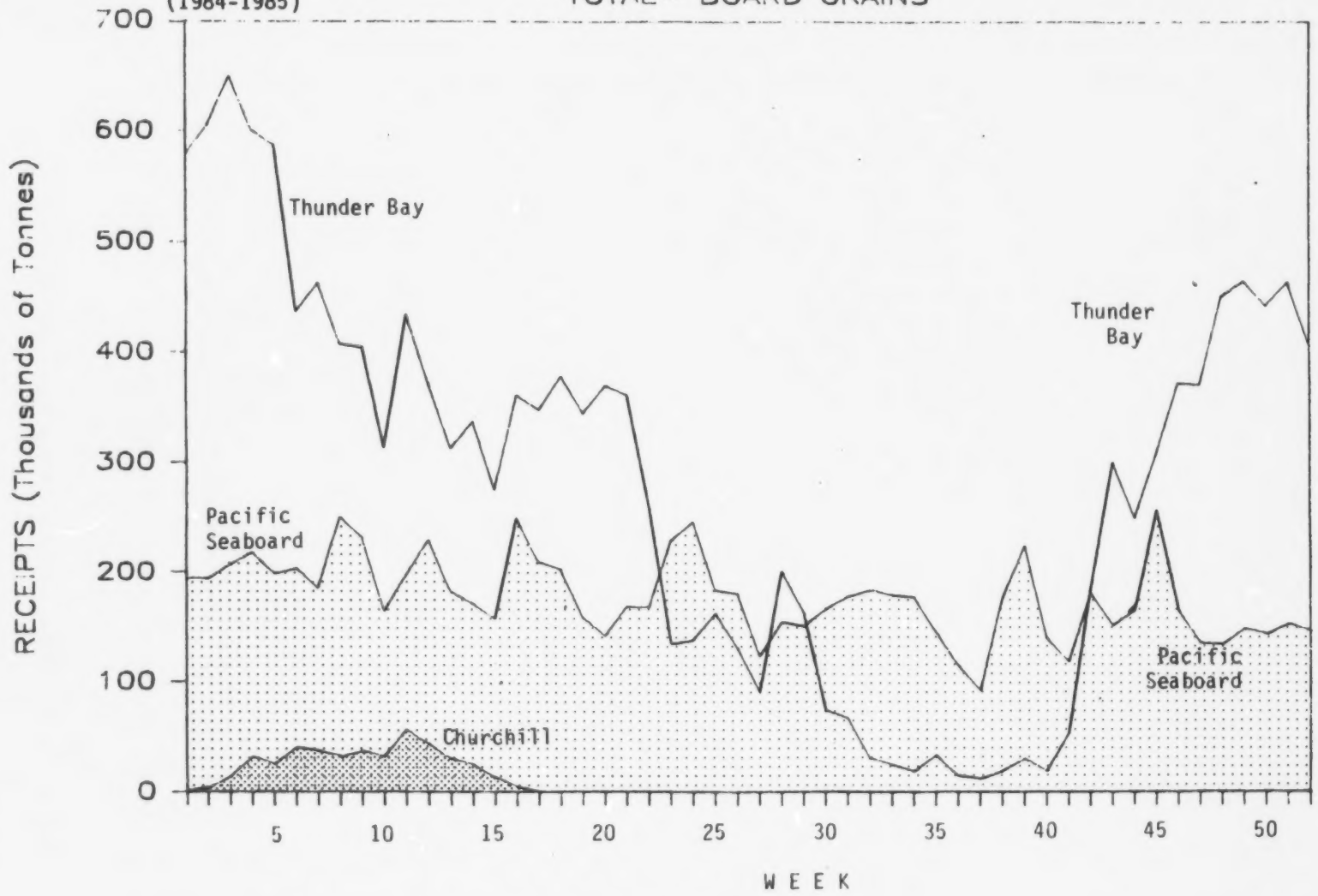
EXHIBIT 2.21

WEEKLY RECEIPTS AT TERMINAL POINTS

(1984-1985) TOTAL -- BOARD GRAINS



Source: Canadian Grain Commission, Weekly Grain Statistics

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Overall, our examination of weekly receipts at the various export grain terminals indicates that, during the Churchill shipping season, the total movement of grain to all terminal elevators does not increase significantly and there is a trade-off of grain flows between Thunder Bay and Churchill. No corresponding interaction is evident between Vancouver and Churchill flows.

2.3.2 Seasonality of Churchill Operations

The arrival of grain at the terminal in Churchill follows the pattern of demand for shipments from the Port, which normally is visited by vessels from approximately the beginning of August to the end of October. The Wheat Board does not normally store grain in the Churchill elevator in anticipation of sales but rather waits until sales are confirmed and vessels are on their way before forwarding grain to Churchill. This policy is designed to avoid extra storage charges in the elevator that could occur if the wrong grain is in position in the Port.

The historic Churchill navigation season corresponds with the harvest period in Canada and other Northern Hemisphere countries. This has two implications:

- shipments occur during a period of the year when there is weak demand for grain. In most countries the new harvest is just coming in and transportation and storage facilities can be congested. International commodity prices reflect this decrease in demand with lower grain prices being normal in the late summer and fall;

- most of the grain being shipped out of Churchill is from the previous crop year, not from the new harvest, as, in order to arrive at Churchill during the navigation season, it must start its movement from the farm approximately two months before. The Wheat Board, in order to avoid the lower prices normally present in the fall, generally tries to minimize the carry-over of grain from one crop year to another. (August 1 is the

beginning of the new crop year). Thus, in a particular year there may or may not be a large inventory of grain available for shipment through Churchill. However, as can be seen from the information presented in this chapter, Churchill shipments represent a small proportion of total grain movement, even during the height of the Churchill navigation season.

2.4 CONCLUSIONS

There are two major conclusions reached on the basis of the information presented in this chapter:

1. Grain exports to the destinations served by Churchill are growing and are expected to continue to grow.

2. During its navigation season, Churchill serves as an alternative to the Thunder Bay/St. Lawrence route with many of the same destination countries being served by both routes, and has little impact on grain flows to the West Coast ports.

3. RATES ANALYSIS

This chapter compares rates for moving export grain through Churchill, through Thunder Bay directly overseas, through Thunder Bay with transshipment at a St. Lawrence Port and through Vancouver. The rate comparisons reflect actual charges paid by shippers in moving grain from the country elevator to a west European port from Churchill and Thunder Bay and to Japan from Vancouver. These shippers include the Canadian Wheat Board, acting on behalf of Prairie grain producers for moving grain to export position (with a subsidy on rail movement from the federal government as discussed in Section 3.1.2), and overseas grain buyers who (in most cases under existing conditions) arrange for the ocean movement from the Canadian port.

It is important to note that in addition to existing rates, exporting grain through Churchill and other ports includes costs that are not reflected directly in the rates paid by shippers; such additional costs are examined in detail in Chapter 4. The rate comparisons developed in this chapter, therefore, show the relative economic efficiency of exporting grain through the alternative ports from the standpoint of shippers using these ports, but not from the broader perspective of Canada as a whole. The latter important comparison is performed in Chapter 4.

3.1 CURRENT RATES

In this section, we present and discuss the current (1985/86) rates paid by shippers for each component of the total grain movement from a country elevator to export destination via the four alternative routings: Churchill, Thunder Bay with direct shipment overseas by ocean-going vessel, Thunder Bay with transshipment at a lower St. Lawrence transfer elevator (to Northwestern Europe) and Vancouver to Japan. The actual rates given are for wheat. Other grains move at similar but slightly different rates, with the differences due mainly to different grain densities.

3.1.1 Primary Elevator Rates

Since grain moves through the same primary elevator regardless of its terminal destination, the primary elevator rate is taken to be the same for each of the alternative routings. Primary elevator rates are published in Canadian Grain Commission tariffs. They vary between companies and, in some cases, between locations. We have used a total rate of $8.50 per tonne, comprised of $6.40 per tonne for elevation (a weighted average over the different elevator companies) and $2.10 per tonne for average storage and shrinkage charges.

It has been argued that additional primary elevator storage charges are incurred in moving grain through Churchill because, with the current shipping season, most of the grain shipped to Churchill is from the previous year's crop. This could result in a higher average storage period for grain shipped through Churchill compared to grain shipped through Thunder Bay or the Pacific ports. However, as shown in the graphs of weekly receipts at terminal points given in Chapter 2, grain is moving in substantial volumes through all ports during the Churchill shipping season. Because of the timing this must mostly be grain from the previous crop year. Therefore, the grain moving through both Churchill and Thunder Bay during the Churchill shipping season has, in general, been stored for the same amount of time, and so we have not assigned any differential storage charges to the Churchill route in our rates comparison.

3.1.2 Rail Rates

The rates paid to the railways for moving Prairie grain to export position are established under the terms of the Western Grain Transportation Act (WGTA). These rates are strictly distance-based, reflecting system-wide average costs for carrying export grain, and do not reflect specific costs of particular routes. Some of the extra costs above the system-wide average incurred by the railway in moving grain to Churchill, as described in Chapter 4, are passed on to Western shippers through inclu-

sion in the WGTA cost base. These extra costs are spread over all shippers.

The total rail rate consists of two parts: a portion paid by the shipper and a portion paid by the federal government. Under the WGTA, the shipper's share will increase over time (assuming continuing inflation) because the Federal contribution is essentially fixed. The rates paid by shippers in 1985/1986 are unusually low due to the substantially reduced export volumes in that year and represent 21.4% of the total rail rate. Appendix B presents details on trends in grain rates over the last three crop years.

In the case of Board grain, the CWB is the shipper and pays the shipper portion of the rate. However, in effect the producer (farmer) pays the grain rate as the shipping charges are deducted from the payment made by the CWB to the producer for the grain. The amount deducted is the shipper portion of the rail rate from the particular primary elevator to Thunder Bay or Vancouver (whichever is closer); it does not (and cannot) reflect the route that that parcel of grain will actually take, whether it ultimately goes to Thunder Bay, Vancouver, Prince Rupert or Churchill. Thus, under the existing system, no producer benefits directly if his grain is shipped to Churchill at a lower rail rate. All producers, however, benefit indirectly from rail rate savings realized by the CWB on grain shipped to Churchill from the area where the statutory rate is lower to Churchill than to Thunder Bay or Vancouver (but all producers also have to share certain costs of keeping the Churchill line in operation, as discussed in Chapter 4) or pay indirectly if grain is shipped to Churchill from areas where the rate is higher than to alternate ports.

Exhibit 3.1 presents the 1985/1986 rail rates for grain to Churchill, Thunder Bay and Vancouver from various origins in the Prairie Provinces, as obtained from tariff CFAW 4310 published by the Canadian Freight Association.

EXHIBIT 3.1

1985/86 RAIL RATES FOR GRAIN*

*as established under the Western Grain Transportation Act

($/tonne)

To / From	CHURCHILL			THUNDER BAY			VANCOUVER		
	Shipper Share	Federal Contribution	TOTAL	Shipper Share	Federal Contribution	TOTAL	Shipper Share	Federal Contribution	TOTAL
BRANDON, MAN.	6.20	22.76	28.96	4.61	16.95	21.56	8.73	32.08	40.81
DAUPHIN, MAN.	5.60	20.58	26.18	4.81	17.67	22.48	8.42	30.94	39.36
MELFORT, SASK.	5.11	18.76	23.87	5.90	21.67	27.57	7.21	26.49	33.70
SASKATOON, SASK.	5.70	20.95	26.65	5.90	21.67	27.57	6.69	24.58	31.27
MOOSE JAW, SASK.	5.90	21.67	27.57	5.60	20.58	26.18	7.09	26.03	33.12
WEYBURN, SASK.	6.00	22.03	28.03	5.31	19.49	24.80	7.67	28.17	35.84
LLOYDMINSTER, SASK.	6.30	23.12	29.42	6.69	24.58	31.27	6.10	22.40	28.50
VERMILION, ALTA.	6.39	23.49	29.88	6.89	25.30	32.19	5.90	21.67	27.57

SOURCE: Tariff CFAW 4310, Canadian Freight Association

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In recent years, the majority of grain shipped to Churchill has originated from CN shipping blocks in Northern Saskatchewan and Northwest Manitoba which have a lower rail rate to Churchill than to Thunder Bay or the West Coast. The Churchill rail rate advantage area is shown on the map in Exhibit 3.2. The map in Exhibit 3.3 shows contours for differentials between the shipper rail rates to Churchill and Thunder Bay from points in the Prairie Provinces. Exhibit 3.4, containing information given in the 1984 Canada Grains Council report Churchill as an Outlet for Prairie Grain, shows that between 1978/79 and 1982/83, an average of 78 percent of wheat and barley shipments to Churchill originated at delivery points within the area where Churchill has a rail rate advantage. The remaining 22 percent of shipments, however, originated from points outside the rail rate advantage area, including points in shipping blocks in Southern Saskatchewan, Southwest Manitoba and Central and Northern Alberta.

We have repeated the analysis of the origins of grain shipped to Churchill, performed earlier by the Canada Grains Council, with updated data on rail car allocations for the 1983, 1984 and 1985 Churchill shipping seasons. The results are presented in Exhibit 3.5. On average during the period 1983 to 1985, 72 percent of the wheat and barley shipments to Churchill originated at points within the Churchill rail rate advantage area, with 28 percent originating outside this area. This observed lower average percentage of Churchill grain originating in the Churchill rail rate advantage area in the last three years compared to the period 1978/79-1982/83 may be partly accounted for by the fact that 1984 and 1985 were poor crop years such that the CWB found it necessary to assemble Churchill grain from a wider than normal area. Because of the significance of the observed movement of grain to Churchill from outside the rail rate advantage area, and also to broaden the analysis, we have included all of the Prairie origins listed in Exhibit 3.1 in our overall rates comparisons. As can be seen only Saskatoon and Melfort lie within the Churchill rail rate advantage area.

The information in Exhibit 3.5 has been used to determine the centroid or "average" origin of grain shipped to Churchill during 1983 -

exhibit 3.2

RAIL RATE ADVANTAGE AREAS

FOR
CHURCHILL, THUNDER BAY &
VANCOUVER/PRINCE RUPERT

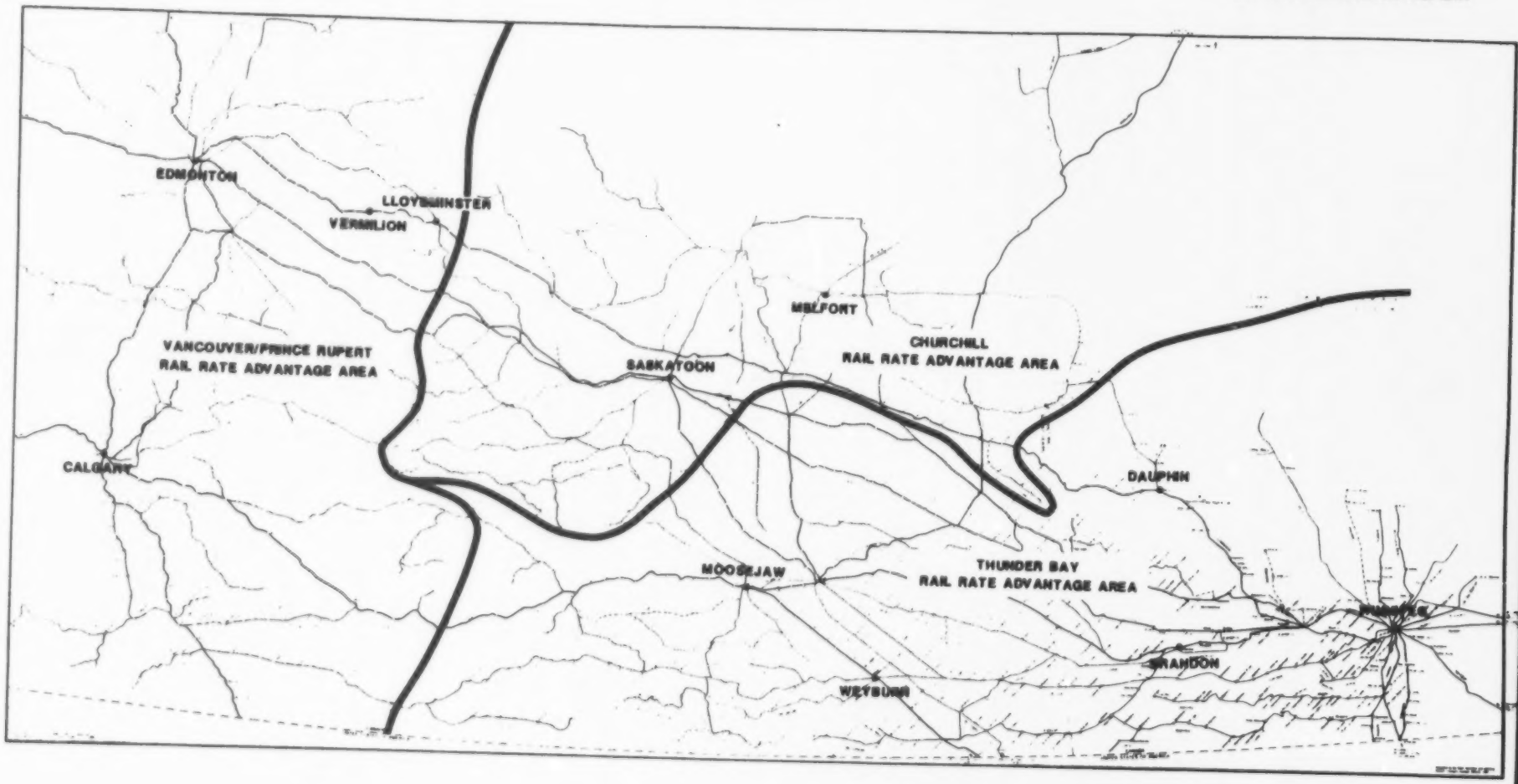

exhibit 3.3

LINES OF EQUAL SAVINGS IN GRAIN RAIL RATES (PRODUCER SHARE):

CHURCHILL VS. THUNDER BAY

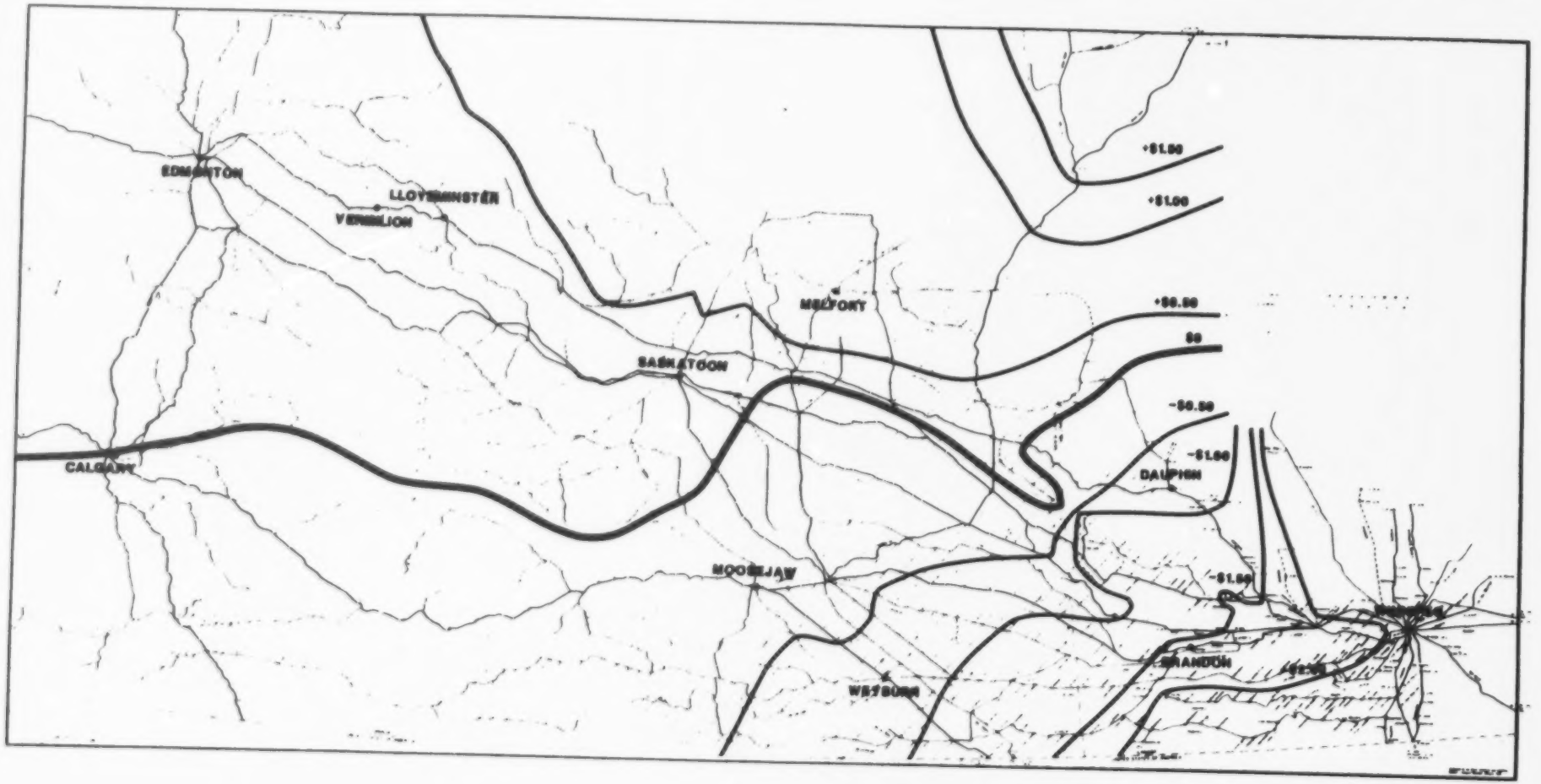

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EXHIBIT 3.4

AVERAGE SHIPMENTS OF WHEAT AND BARLEY TO CHURCHILL BY SHIPPING BLOCKS: 1978/79 TO 1982/83

Shipping Block	Average Shipments (Tonnes)			Proportion of Shipments %		
	From Churchill Rail Rate Advantage Area	From Outside Churchill Rail Rate Advantage Area	Total	Advantage	No Advantage	Total
13 Dauphin	58,683	32,363	91,046	12.8	7.0	19.8
29 Prince Albert West	84,045		84,045	18.3	-	18.3
15 Kamsack	66,045		66,045	14.4	-	14.4
25 Prince Albert East	56,235		56,235	12.2	-	12.2
27 Prince Albert South	34,225		34,225	7.4	-	7.4
23 Saskatoon North	16,940		16,940	3.7	-	3.7
41 Edmonton North		16,263	16,263	-	3.5	3.5
37 Biggar North	5,350	6,753	12,103	1.2	1.5	2.6
43 Edmonton South		12,006	12,006	-	2.6	2.6
21 Saskatoon West	10,379		10,379	2.3	-	2.3
76 Wilkie (CP Rail)	2,938	7,228	10,166	0.6	1.6	2.2
17 Saskatoon Main	2,390	5,415	7,805	0.5	1.2	1.7
74 Bredenbury (CP Rail)	7,205		7,205	1.6	-	1.6
45 Edmonton West		7,081	7,081	-	1.5	1.5
75 Saskatoon (CP Rail)	7,063		7,063	1.5	-	1.5
39 Biggar West	4,551	1,470	6,021	1.0	0.3	1.3
90 N.A.R. East		4,458	4,458	-	1.0	1.0
33 Regina South		2,346	2,346	-	0.5	0.5
19 Saskatoon South	2,118		2,118	0.5	-	0.5
11 Melville	1,503	493	1,996	0.3	0.1	0.4
31 Saskatoon East	623	993	1,616	0.1	0.2	0.3
49 Hanna West		1,609	1,609	-	0.3	0.3
09 Brandon West		773	773	-	0.2	0.2
95 N.A.R. West		151	151	-	-	-
35 Regina West		16	16	-	-	-
87 Edmonton (CP Rail)		11	11	-	-	-
TOTAL	360,293	99,429	459,722	78.4	21.6	100.00

SOURCE: Canada Grains Council, Churchill as an Outlet for Prairie Grain, May, 1984

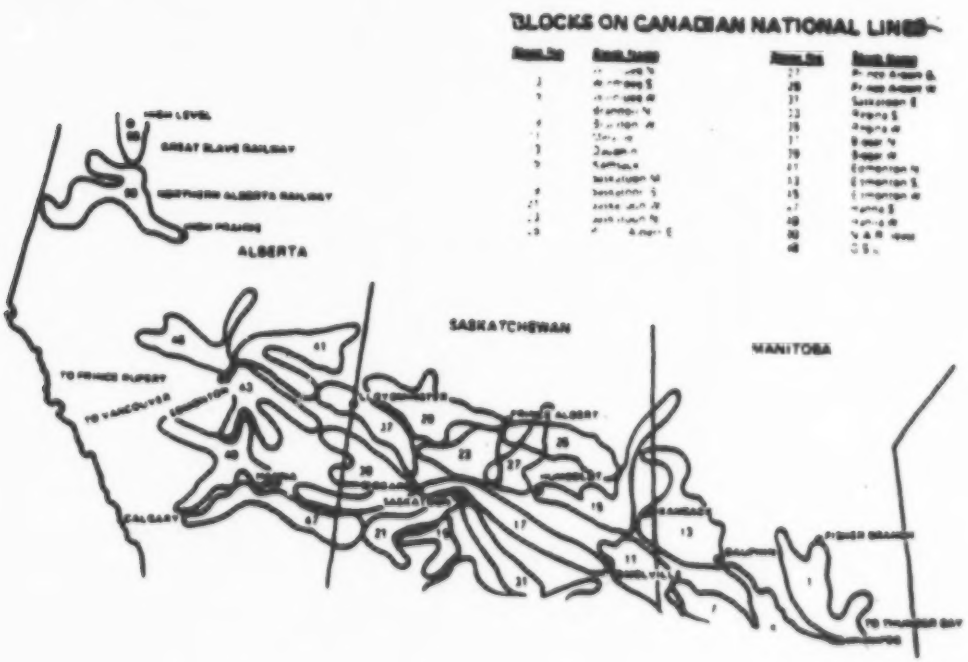

EXHIBIT 3.5

AVERAGE SHIPMENTS OF WHEAT AND BARLEY TO CHURCHILL BY SHIPPING BLOCK: 1983, 1984 and 1985 CHURCHILL SHIPPING SEASONS

Shipping Block	Average Shipments* (Tonnes)			Proportion of Shipments %		
	From Churchill Rail Rate Advantage Area	From Outside Churchill Rail Rate Advantage Area	Total	Advantage	No Advantage	Total
21 Saskatoon West	70,693		70,693	14.3	-	14.3
13 Dauphin	37,860	20,880	58,740	7.7	4.2	11.9
29 Prince Albert West	51,920		51,920	10.5	-	10.5
15 Kamsack	45,283		45,283	9.2	-	9.2
19 Saskatoon South	42,918		42,918	8.7	-	8.7
25 Prince Albert East	41,195		41,195	8.2	-	8.2
27 Prince Albert South	23,943		23,943	4.7	-	4.7
41 Edmonton North		22,900	22,900	-	4.7	4.7
33 Regina South		22,733	22,733	-	4.6	4.6
17 Saskatoon Main	6,574	14,894	21,468	1.3	3.0	4.3
31 Saskatoon East	8,227	13,113	21,340	1.7	2.6	4.3
23 Saskatoon North	12,357		12,357	2.5	-	2.5
39 Biggar West	9,229	2,981	12,210	1.9	0.6	2.5
43 Edmonton South		11,733	11,733	-	2.4	2.4
37 Biggar North	3,266	4,122	7,388	0.7	0.8	1.5
45 Edmonton West		5,463	5,463	-	1.1	1.1
3 Winnipeg South		5,170	5,170	-	1.0	1.0
35 Regina West		4,932	4,932	-	1.0	1.0
11 Melville	3,023	992	4,015	0.6	0.2	0.8
5 Winnipeg West		3,373	3,373	-	0.7	0.7
9 Brandon West		2,768	2,768	-	0.6	0.6
7 Brandon North		880	880	-	0.2	0.2
1 Winnipeg North		752	752	-	0.2	0.2
TOTAL	356,488	137,686	494,174	72.0	28.0	100.00

* Calculated using the following assumptions:

(i) Average boxcar loading = 55 tonnes
(ii) Within joint advantage-disadvantage blocks, shipments are assumed to have originated from advantage and disadvantage points in the same proportions as those found by the Canada Grains Council for 1978/79 to 1982/83

SOURCE: Canadian Wheat Board Car Allocations

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1985 by calculating the weighted average rail rates to Churchill and Thunder Bay over all originating shipping blocks, weighted by the proportions of Churchill shipments originating in each block. It was found that, on the average, grain moved to Churchill had a $0.95 per tonne full rail rate advantage over moving the same grain to Thunder Bay, using 1985/86 rates. This compares closely with the case of Saskatoon whose full rail rate to Churchill is $0.92 per tonne less than to Thunder Bay. In many of the subsequent tables, therefore, Saskatoon has been used as representative of the "average" Churchill grain origin point.

At the present time grain is shipped to Churchill only from CN lines. A test was performed in 1980 to examine the feasibility of interchanging traffic between CN and CP so that CP originated grain could also move to Churchill. The review of this trial by the CTC[1] concluded that:

- the interchange is feasible;
- some capital improvements would be necessary;
- the overall operating cost savings would be small;
- there would have to be a rate sharing agreement made between the two railways.

Since 1980 there have been no such interchanges. If CP lines could originate traffic for Churchill, the total car mileage required for Churchill would decrease, with grain from nearer CP lines replacing grain from further CN lines.

The comparisons described in this section indicate that the majority of grain moving through Churchill is coming from the Churchill rate advantage area. If grain could also move to Churchill from CP lines, an even higher proportion could do so. Information presented in Appendix A

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1. Canadian Transport Commission, "Hudson's Bay Railway Interchange Study", Research Branch, 1981.

of Study B on production by crop district shows that more than sufficient grain is grown in this area to supply current levels of Churchill movement.

3.1.3 Terminal Elevator Rates

Terminal elevator rates have been obtained from tariffs published by the Canadian Grain Commission. The total 1985 rates paid by the shipper are about $8.80 per tonne at Churchill and about $7.80 per tonne at Thunder Bay and Vancouver. These totals include charges for elevation, cleaning, storage, outward fees and other fobbing charges. A breakdown of the charges by category is given in Exhibit 3.6. The $1.00 per tonne differential between Churchill and Thunder Bay and Vancouver reflects higher elevation, cleaning and fobbing charges per tonne at Churchill. As rates are intended to cover costs and are regulated by the Canadian Grain Commission, the higher rates at Churchill should reflect higher costs. The Port Manager has stated that a large proportion of the difference is due to higher energy charges in Churchill. These higher energy charges are expected to be reduced in the future with the construction of a power transmission line to Churchill. The cost per tonne will also be sensitive to reductions with increased grain throughput at Churchill as described more fully in Chapter 2 of Study A (re: capacity) and Chapter 4 of this report.

It should be noted that the storage charge of $.93 per tonne assumed for all three ports represents the actual charge at Churchill with an observed average storage time for grain of 27 days. Because, as shown in the Canada Grains Council report cited previously, the Churchill terminal normally has a higher turnover ratio (throughput/capacity) during its operating season than terminals at Thunder Bay and Vancouver[2], the average storage time and hence storage charges at Churchill could be somewhat lower

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2. In 1982/83, the average turnover ratios expressed on the basis of turnovers per year if each port had a full year shipping season were 15.9, 11.8, and 11.6 respectively for Churchill, Thunder Bay and the Pacific Coast, based on estimates given in the 1984 Canada Grains Council report Churchill as an Outlet For Prairie Grain.

EXHIBIT 3.6

COMPARATIVE TERMINAL CHARGES FOR WHEAT - 1985/86
($/tonne)

	CHURCHILL	THUNDER BAY AND VANCOUVER
Elevation	4.71	4.31
Cleaning	2.07	1.67
Storage	.93	.93*
Outward Fees	.79	.79
Other Fobbing (Wharfage)	.30	.10
TOTAL	8.80	7.80

* assumes average storage period of 27 days at Churchill also applies at other ports.

SOURCE: Canadian Grain Commission Tariffs and information on revenues at the Port of Churchill

than at the other ports. However, the throughput ratios for Thunder Bay and Vancouver are for all grains in total including non-Board grains such as rapeseed (canola), rye and flaxseed which are reported to have longer storage times. Hence, we have assumed equal storage charges for wheat at all three ports in the comparison of Exhibit 3.6.

3.1.4 Lake Transportation

A current lake transportation charge of $16.00 per tonne has been obtained from Wheat Board information on the cost of moving wheat from in store Thunder Bay to in-store St. Lawrence Port. The $16.00 per tonne includes approximately $1.18 per tonne in St. Lawrence Seaway Authority tolls. It should be noted that the average laker rate paid for grain transportation by the Wheat Board in a given year depends on the relative proportions of grain that move under contract and spot rates. The Wheat Board has entered into contracts with lake carriers in order to provide rate stability and to ensure that sufficient lake fleet capacity is available by providing assurances of business to encourage the carriers to build new vessels as required. Spot rates are those that are negotiated with carriers for specific movements at a particular point in time and reflect marine freight market conditions at that time. Due to the low volume of Canadian export grain on the Great Lakes and St. Lawrence this year, a large portion of this grain is currently moving under contract rates. In future years, as grain volumes return to normal levels, the average rate paid by the CWB may decrease somewhat because more grain will be moving at spot rates which are currently significantly lower than the contract rates. As grain volumes return to normal levels and the demand for laker service increases, however, the market driven spot rates will increase.

3.1.5 Transfer Elevator Rates

A total rate of $5.10 per tonne for elevation, storage and fobbing at a St. Lawrence transfer elevator has been obtained based on Canadian Grain Commission approved tariffs.

3.1.6 Ocean Freight Rates

Exhibit 3.7 presents average voyage charter ocean freight rates[3] from 1976 to the present from Churchill, Thunder Bay and St. Lawrence ports to Northwestern Europe and from the West Coast to Japan. Northwestern Europe was defined to include the Atlantic coasts of France, Belgium, the Netherlands, and the Scandinavian countries, all of the British Isles, and the port of Hamburg, in West Germany. Although some distortion of the relative average rates determined for the alternative origins to Northwestern Europe might arise because of some differences in the breakdowns of the specific destinations used for each origin and year, we believe that this distortion is small because rates to the various areas of Northwestern Europe listed above from a Canadian port at a particular time for a given size of vessel historically have been very similar. These average rates are based on individual voyage charter rates reported in the Chartering Annual published by Maritime Research Inc.

The number of rates reported for Churchill in this publication is limited because many of the vessels using Churchill are owned by the state shipping companies of Third World or Eastern Bloc nations. The rate or cost structure of the Eastern Bloc national shipping fleets is not available. Over the last three years almost all of the non-Eastern Bloc shipments from Churchill were on a voyage charter arrangement. Therefore, the voyage charter rates given for Churchill are felt to be representative and the best basis of comparison available. In 1977, 1980 and 1984 there were no published voyage charter rates for movements from Churchill to Northwestern Europe because most of the grain passing through Churchill in those years went to Eastern Bloc countries or to other nations having state shipping companies. The ocean rates presented for 1985 have been estimated using a combination of 1985 reported rates in the Chartering Annual and discussions with shipping companies.

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3. A voyage charter rate is an all-inclusive market rate charged to the shipper for a single, one-way trip. Other kinds of rates are charged under other types of charters such as trip charters and time charters, as discussed in Chapter 5.

EXHIBIT 3.7

VOYAGE CHARTER OCEAN FREIGHT RATES[1] FOR GRAIN TO NORTHWESTERN EUROPE

	$U.S./LONG TON[2]				
YEAR	CHURCHILL	ST. LAWRENCE PORTS (all vessels)	ST. LAWRENCE PORTS (smaller vessels[3])	THUNDER BAY DIRECT	CANADIAN WEST COAST TO JAPAN
1976	9.50	5.80	6.55	17.00	14.40
1977	-	4.31	7.00	15.35	12.25
1978	15.10	7.90	8.80	20.30	14.00
1979	26.00	15.00	16.10	35.30	27.00
1980	-	17.90	18.95	36.60	27.00
1981	17.30	10.90	13.00	27.30	20.30
1982	10.50	7.41	8.55	22.90	15.20
1983	12.90	8.80	9.50	20.80	15.90
1984	-	10.00	10.10	19.70	17.10
1985[4]	11.40	8.30	10.00	16.00	13.50

1. Averaged over the period from late July to late October corresponding to the Churchill shipping season
2. Long Ton = 2,240 lbs. = 1.016 tonne
3. Vessels loading less than 40,000 tons
4. Based on rates between July 13 and October 5, 1985

SOURCE: Maritime Research Inc., Chartering Annual (1976-85)

We have used Northwestern Europe as the destination in our rates comparisons because substantial proportions of the grain exported through Thunder Bay and Churchill move to Northwestern Europe and vessels trading to destinations there are commonly hired on the charter market so that published rates are readily available. As described in Section 2.2.1, between 1974 and 1985, 55.5% of the grain shipped through Churchill went to Eastern Europe (mainly Poland and the USSR) and 15.8% went to Mediterranean and Persian Gulf destinations, with 23.9% going to Western Europe. If sufficient numbers of ocean rates to these other destinations were published, it would be useful to compare the total rates for shipping grain from the Prairies to Eastern Europe and to the Mediterranean via the alternative routings. For shipment to Baltic ports in Eastern Europe, however, the ocean rate differentials between the various Canadian ports should be very similar to those for Northwestern Europe because the same relative differential voyage length as to Northwestern Europe would be required. Ports to the north of the Hamburg-Antwerp range used as the destination in the comparisons will show results more favourable to Churchill. For shipment to the Mediterranean, the distance from Churchill is relatively greater compared to the distances from Thunder Bay and the St. Lawrence than is the case for shipment to Northwestern Europe and Eastern Europe (Baltic). In Appendix G, a comparison of total rates to Marseilles (from Saskatoon) is given which uses estimated ocean rates based on the ocean freight cost model discussed in Section 3.1.7. These results are of course less favourable to Churchill.

Exhibit 3.8 presents the ranges of actual rates reported for each routing to Northwestern Europe or Japan for each year during the Churchill shipping season. It is seen that, with the exception of the Canadian West Coast to Japan in most years, these ranges are fairly large. Part of the variability arises from seasonal changes in market conditions that normally occur within the July-October period each year (rates normally increase over this period each year), and the remainder arises due to the fact that there is a spread of rates negotiated even for the same time period which reflects such elements as vessel size, availability of return cargos, etc.

EXHIBIT 3.8

OBSERVED RANGE OF VOYAGE CHARTER OCEAN FREIGHT RATES[1] FOR GRAIN TO NORTHWESTERN EUROPE

	$U.S./LONG TON[2]				
YEAR	CHURCHILL	ST. LAWRENCE PORTS (all vessels)	ST. LAWRENCE PORTS (smaller vessels[3])	THUNDER BAY DIRECT	CANADIAN WEST COAST TO JAPAN
1976	9.50 (one rate)	4.85 - 8.50	4.85 - 8.50	12.00 - 20.00	13.50 - 15.50
1977	-	3.50 - 7.00	7.00 (one rate)	13.20 - 16.75	11.15 - 12.90
1978	14.75-15.50	6.50 - 10.00	7.45 - 10.00	17.40 - 23.90	10.35 - 17.95
1979	20.00-29.90	11.00 - 25.00	13.50 - 25.00	22.00 - 46.00	23.60 - 28.70
1980	-	15.00 - 22.30	15.75 - 22.30	28.00 - 44.00	24.90 - 28.50
1981	14.40-20.15	7.50 - 14.00	9.50 - 14.00	20.10 - 35.00	19.10 - 21.75
1982	10.50 (one rate)	5.25 - 12.50	6.75 - 12.50	20.00 - 25.50	14.40 - 15.75
1983	10.70-16.75	5.75 - 12.75	7.00 - 12.75	17.75 - 25.00	15.00 - 18.50
1984	-	7.90 - 12.75	7.90 - 12.75	16.00 - 24.75	15.75 - 17.25
1985[4]	8.25-14.00	7.25 - 10.00	10.00 (one rate)	12.75 - 19.00	13.00 - 14.25

1. For the period from late July to late October corresponding to the Churchill shipping season
2. Long Ton = 2,240 lbs. = 1.016 tonne
3. Vessels loading less than 40,000 tons
4. Based on rates between July 13 and October 5, 1985

SOURCE: Maritime Research Inc., Chartering Annual (1976-85)

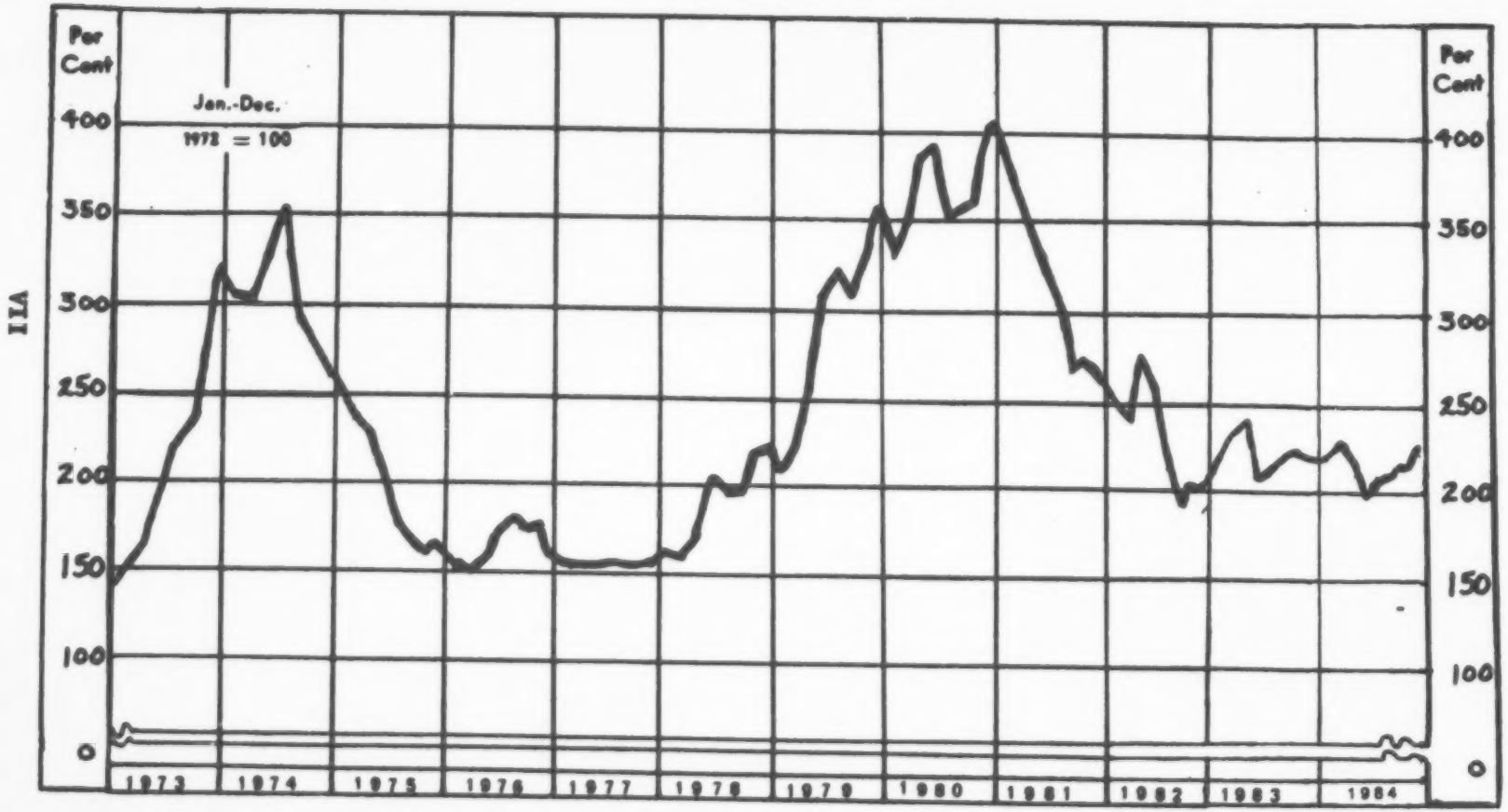
It is seen in Exhibit 3.7 that ocean rates rose to peak levels in 1980, but have dropped substantially since then. Rates are currently at depressed levels due to a reduced worldwide demand for shipping, oversupply of tonnage and reduced oil prices. The depressed market for ocean shipping is expected to continue for the next several years.

A longer-range perspective on the behaviour of the ocean freight market is provided by Exhibit 3.9, which shows movements of the general freight charter price index (calculated by Maritime Research Incorporated) since 1973. This price index is an average for bulk vessel voyage charters including different types of bulk cargo, but inspection has indicated that it very closely parallels changes in rates for grain cargos. This would be expected as grain is a major commodity moving by ocean vessel and because the same dry bulk cargo vessels can carry grain and other bulk commodities.

It is evident that 1980 represented a historical peak year for charter rates, while current levels are only about 25% higher than those experienced during the weak market of 1976-1977. Therefore, the rate differentials shown in Exhibit 3.8 between the various export grain routings cover both high and low years for the shipping market. Unfortunately, no rate was available for Churchill in 1980 because all shipments went to Eastern Bloc countries in that year, but assuming that the increase over the 1979 level was equal to the 13% increase in the General Freight Index between September 1979 and September 1980, we can estimate that the average voyage charter rate for grain from Churchill in 1980 would have been about $29.40 ($ U.S.) per long ton. This suggests that the maximum average ocean freight rate differential during the past decade between Churchill and the St. Lawrence ports, respectively, and Northwestern Europe, which occurred during the strong ocean shipping market of 1980, is on the order of $11.50 ($ U.S.) per long ton, or $15.40 ($ Canadian) per tonne (using the late 1985 exchange rate of $1.00 U.S. equals $1.36 Canadian). In the weak ocean freight market of 1985, this rate differential narrowed to about $4.15 Canadian per tonne on average. Discussions with ocean shipping companies

EXHIBIT 3.9

WEEKLY GENERAL FREIGHT CHARTER INDEX: 1973-1984



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Taken from: Maritime Research Incorporated, Chartering Annual, 1984

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have confirmed that there are substantial increases in this differential in years of strong market demand for ocean shipping and substantial reductions in the differential in years of weak demand. In periods of high demand carriers can be more selective in taking on business; there is a tendency to charge higher rates for business which is seen as being less desirable.

The observed high degree of variability in ocean rates over time shows that relative rates between the various alternative routings are subject to considerable change depending on market conditions. We have therefore developed rate comparisons under three different scenarios for the ocean freight market:

- o low market (depressed rates - oversupply of vessels relative to demand);
- o medium market (medium rates - vessel supply and demand in balance);
- o high market (peak rates - shortage of vessels relative to demand).

The years 1985, 1981 and 1980 have been selected to represent low, medium and high market conditions respectively reflecting conditions as illustrated in Exhibit 3.9. The average rates for the alternative routings for these years, converted to Canadian dollars per tonne, are summarized in Exhibit 3.10. No correction has been made for inflation since 1980. While labour costs have increased over this period, fuel costs have declined.

Finally, it may also be noted from Exhibit 3.7 that the ocean rate for the size of vessels typically calling at Churchill, those loading less than 40,000 tonnes, using the St. Lawrence ports has been on average only about 10% higher than the average rate for all vessel sizes. This reflects the observation that even though the St. Lawrence ports can handle larger vessels than Churchill, less than half of the vessels loading grain at the St. Lawrence ports have been large (loading greater than 40,000

EXHIBIT 3.10

OCEAN FREIGHT RATES FOR GRAIN TO NORTHWESTERN EUROPE UNDER DIFFERENT SCENARIOS FOR THE OCEAN FREIGHT MARKET

(Rates in $Can./tonne, rounded to nearest ten cents)

	SCENARIO		
Rate to Northwestern Europe from	Low Market (1985)	Medium Market (1981)	High Market (1980)
CHURCHILL	15.30	23.20	39.40
THUNDER BAY DIRECT	21.40	36.50	49.00
ST. LAWRENCE PORTS	11.10	14.60	24.00

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tonnes). This may be due to draft restrictions at destination ports overseas or to grain market requirements.

It should also be noted that the majority of ocean-going vessels sailing from Thunder Bay top off (take on more grain) at St. Lawrence ports. These vessels cannot carry their full capacities through the St. Lawrence Seaway system because of its restricted allowable draft. The cargo tonnages moved from Thunder Bay and from the St. Lawrence obviously share the ocean voyage costs of the journeys. There may or may not be some cross-subsidy between these two movements (with the top-off grain subsidizing the movement of the Thunder Bay grain) although market considerations must prevent large cross-subsidies. We have therefore used the quoted actual rates for the grain moving from Thunder Bay directly overseas. In considering the Thunder Bay direct routing in the rate comparisons, we have assumed that the relatively small incremental grain volumes that might be shifted between Churchill and Thunder Bay routes would not be sufficient to materially affect the availability of grain for topping off on the St. Lawrence. Hence, ocean rates for the Thunder Bay direct routing can be assumed to be independent of the volume of grain going to Churchill.

The ocean rates shown for direct shipment from Thunder Bay include the SLSA tolls normally paid by the shipowner (lockage fees and Gross Registered Ton tolls) but not those normally paid by the shipper (cargo tonnage tolls). The cargo tonnage tolls in 1985 were $0.83 per tonne and these were included in the overall comparison (see Exhibit 3.13).

3.1.7 Ocean Freight Costs

As seen in the previous section, ocean freight rates at any given time primarily reflect prevailing market conditions. Furthermore, from the perspective of Prairie grain shippers, ocean rates are external costs. Losses (or profits) realized by world shipowners are not subsidized by Canadian producers while, for example, under the WGTA, railway losses on

grain dependent branch lines will be passed on to producers as a whole through the rail rates. Therefore it is the ocean freight rates that are important to the Canadian shipper (and to the buyer) rather than the shipowners' costs. Nevertheless, examination of actual costs to shipowners of owning and operating ocean vessels on the alternative grain export routes can provide some insights into the reasons for observed rate differentials, as well as estimates of long term average rates.

To estimate current costs to shipowners, we have developed a simplified ocean freight cost model. The model has been developed using representative operational cost information for ocean bulkers obtained from three main sources: the 1984 study Bulk Carrier Costs and Profitability to 1995 prepared by C.S.R. Consultants, shipowner companies and marine experts. Details of the model structure and parameter values used are presented in Appendix D.

The results of the model are summarized in Exhibit 3.11. Total costs per tonne have been developed for 25,000 and 40,000 deadweight tonne non ice-strengthened bulkers for movement from each of Churchill, Montreal, Baie Comeau and Thunder Bay to Antwerp/Rotterdam. These costs apply to new bulkers built in the early 1980s sailing under Western European flags. The costs for older vessels and vessels sailing under flags of convenience or with crews of other nationalities would be somewhat lower. The estimated costs should therefore be taken as representative of higher cost operations so that actual average cost differentials over all vessels might be somewhat lower than those given in Exhibit 3.11.

The total cost estimated for a round trip voyage of a 25,000 DWT bulker from Churchill to Antwerp/Rotterdam assuming zero backhaul is $20.14 per tonne. The actual average 1985 charter rate of $15.30 per tonne from Churchill suggests that current rates from Churchill would cover about 75 percent of total costs of a vessel making this type of journey. Of course the real world is more complex than this with vessels likely to find other cargos to cover at least some of their backhaul costs. For Montreal and

EXHIBIT 3.11

ESTIMATED OCEAN FREIGHT COSTS TO ANTWERP/ROTTERDAM*

($CDN/tonne)

VESSEL TYPE FROM	0% BACKHAUL				25% BACKHAUL				50% BACKHAUL				80% BACKHAUL			
	Churchill	Montreal	Baie Comeau	Thunder Bay	Churchill	Montreal	Baie Comeau	Thunder Bay	Churchill	Montreal	Baie Comeau	Thunder Bay	Churchill	Montreal	Baie Comeau	Thunder Bay
25,000 DWT Non Ice-Strengthened Bulker	20.14	16.35	14.25	29.45	16.70	13.49	11.73	24.07	-	11.59	10.05	20.66	-	10.00	8.65	18.01
40,000 DWT Non Ice-Strengthened Bulker	17.17	14.07	12.30	-	14.33	11.67	10.19	-	-	10.08	8.78	-	-	8.75	7.61	-

DWT = Deadweight tonnes

* For a round trip

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Baie Comeau the estimated costs for a 25,000 DWT bulker with zero backhaul are $16.35 per tonne and $14.25 per tonne respectively. The actual observed 1985 average rate of $13.40 per tonne for smaller vessels loading at St. Lawrence ports represents about 80 to 90 percent of these estimated costs. The Thunder Bay cost is based on the use of a 25,000 DWT vessel which can carry 18,000 tonnes through the Seaway and then tops up with another 7,000 tonnes at a St. Lawrence port. The total cost of $31.65 per tonne is based on the part of the total ship operating cost that can be allocated to the trip from Thunder Bay to the St. Lawrence plus 72 percent (18,000/25,000) of the cost of the ocean portion of the voyage.

For a 40,000 DWT bulker, the estimated costs with zero backhaul are $17.17 per tonne from Churchill, $14.07 per tonne from Montreal and $12.30 per tonne from Baie Comeau. In the past Churchill has loaded such large vessels although there were delays experienced because of insufficient depth of water at low tide and problems because the present loading gallery was not high enough at high tide. If the harbour at Churchill is dredged to a depth of 11.6 m. as called for in the Canada-Manitoba Subsidiary Agreement, Churchill will be able to serve 40,000 plus DWT vessels more efficiently. Based on the above cost estimates, use of these larger vessels would provide a cost saving for a vessel moving grain from Churchill to Antwerp/Rotterdam of about $3.00 per tonne (for the grain loaded into these vessels) versus the cost for 25,000 DWT vessels.

Vessels carrying grain from the St. Lawrence ports to Europe, however, do obtain backhaul cargo to North America such as steel. We have used the cost model to estimate vessel costs from Montreal and Baie Comeau assuming three different levels of backhaul: 25, 50 and 80 percent. As seen in Exhibit 3.11, estimated vessel costs fall significantly with greater backhauls.[4] With 80 percent backhaul available, the costs from

4. The estimated vessel costs for grain with different backhaul percentages assume, strictly speaking, that the backhaul commodity is loaded at the same port (Antwerp or Rotterdam) where the grain is unloaded. If a triangular haul is required involving significant empty sailing time between the grain unloading port and the backhaul commodity loading port, the backhaul percentage is effectively reduced and the costs allocated to the forehaul grain would be greater.

Montreal and Baie Comeau for a 40,000 DWT bulker are only $8.75 per tonne and $7.61 per tonne respectively. Actual backhauls, however, are currently reported to be in the range of 60 to 70 percent by weight and somewhat less by revenue since inbound rates are currently marginally lower than outbound rates. A 50 percent backhaul by revenue is therefore fairly typical which (from Exhibit 3.11) would give an estimated cost from Baie Comeau to Antwerp/Rotterdam of $10.05 per tonne for a 25,000 DWT bulker (versus an average 1985 rate of $13.40) and an estimated cost for a 40,000 DWT bulker of $8.78/tonne (versus a 1984 rate of $10.04 per tonne).

Regarding the composition of vessel costs from Churchill, the model suggests that the extra insurance premium of approximately $40,000 (for a non ice-strengthened vessel) set by the Churchill clause of Lloyd's of London for navigation between the dates of July 23rd and October 20th comprised about 7 percent of the total cost for a return voyage. This figure was reported by Johnson & Higgins to be representative of the amounts actually paid. Total elimination of the extra premium would reduce the ocean freight cost from Churchill and its margin above the ocean costs from the St. Lawrence ports by about $1.60 per tonne.

In this regard, Lloyd's of London has recently announced that they will henceforth assess extra premiums for voyages to Churchill on a ship-by-ship basis, taking into account the time of season, vessel type, the experience of the ship's captain in ice navigation, and other factors. Thus, for certain vessels, the insurance cost component of using Churchill may now be significantly reduced. Unfortunately there has been insufficient time since this change to gain experience with the new rates. The cost from Churchill could be further reduced if the time in Port at Churchill (which averaged 5.2 days over the period 1982 - 1984) could be reduced towards the levels experienced at Montreal and Baie Comeau (about 3 days and 2 days respectively). A one day reduction in average time spent in port at Churchill would reduce the cost of the Churchill routing by about 50¢ per tonne.

We conclude from the ocean bulk vessel cost model results that the cost differential to the shipowner of carrying grain from Churchill to Northwestern Europe versus a St. Lawrence port to Northwestern Europe is currently on the order of $8 to $12 per tonne (for the higher cost type operations considered in the model). This range is reasonably consistent with the observed rate differential of $8.60 per tonne in the medium market year of 1981, but is significantly higher than the current (1985) rate differential of about $4.20/tonne which reflects depressed ocean freight market conditions, and significantly lower than the estimated rate differential of about $15.40/tonne which reflected high ocean freight markets in 1980.

Exhibit 3.12 shows the behaviour of different cost elements for ocean bulk vessels over the last decade. It can be seen that, with the exception of fuel, costs have shown relatively steady increases over this period. These cost trends should be contrasted with the trends in bulk cargo rates as shown on Exhibit 3.9 which indicates that rates are much more volatile than costs, being determined primarily by cyclical demand/supply conditions in the ocean freight market.

In subsequent analysis we have used rates as the most suitable basis of comparison between routes as they represent the actual cost to the shipper and buyer of grain.

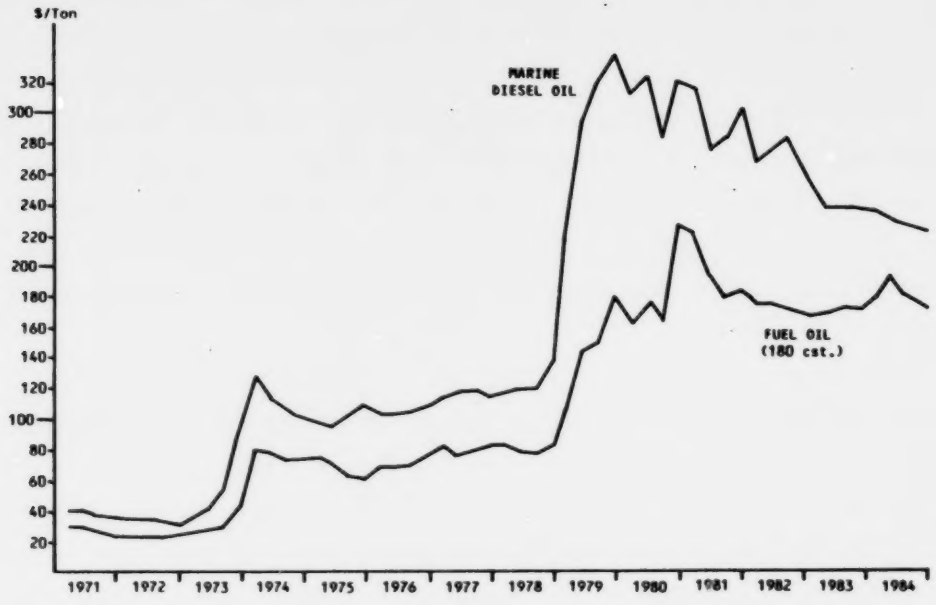
3.2 TOTAL RATES COMPARISONS

The rates described in section 3.1 for each of the various handling and transportation components in the movement of export grain from the Prairie Provinces have been combined to make overall rate comparisons between Churchill and the alternative export routes. Two types of comparisons have been made: comparisons of current rates and comparisons of rates under the low, medium and high scenarios for the ocean freight market described in section 3.1.6. The results are discussed below.

EXHIBIT 3.12

HISTORICAL OPERATING COST TRENDS FOR BULK OCEAN VESSELS

FIGURE 6.1
QUARTERLY AVERAGE SPOT BUNKER PRICES AT ROTTERDAM



Source: Drewry Shipping Consultants Ltd., Bulk Shipping Costs and Commodity Markets, London, May 1985

TABLE 1.1
AVERAGE MANNING COSTS ON DRY BULK CARRIERS
1973-83 (US $'000 per Annum)

	1973	1981	1982	1983(a)
Convenience Flag				
± 25,000 DWT	320	650	720	765
± 40,000 DWT	335	680	750	795
± 60,000 DWT	345	710	800	840
±120,000 DWT	420	800	900	950
North European Flag				
± 25,000 DWT	470	950	975	965
± 40,000 DWT	495	1,015	995	985
± 60,000 DWT	515	1,050	1,030	1,010
±120,000 DWT	600	1,150	1,125	1,100

(a) estimated figures.

Source: Drewry Shipping Consultants Ltd., Dry Bulk Carrier Operating Costs - Past Present and Future, London, 1984

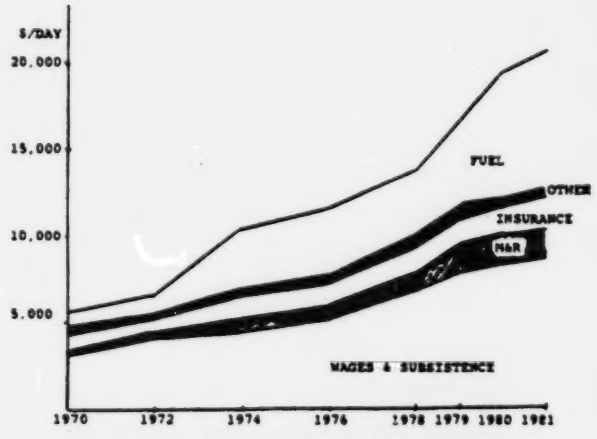


Fig. 3a Daily operating expenses in current dollars

NOTE: The $/day scale is a measure of total daily costs; the amount for each category of expense is shown by the height of the band.

Source: Comparative Operating Costs for U.S. and Foreign-Flag Ships, Paul Ackerman, Maritime Administration, Washington, D.C., 1982

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3.2.1 Comparison of Current Rates

Exhibit 3.13 compares the total 1985 rates paid by shippers to move wheat from Saskatoon, Saskatchewan, to Northwestern Europe via Churchill and Thunder Bay. Saskatoon was selected as an initial origin for comparative purposes because as described in section 3.1.2, it represents the centroid for the grain which actually moved to Churchill during the period 1983 - 1985. The exhibit shows that the total rate paid by shippers to move grain from Saskatoon to Northwestern Europe is lower through Churchill than through Thunder Bay. The current rate savings are on the order of $7.00 per tonne versus Thunder Bay direct and $17.00 per tonne versus Thunder Bay and a St. Lawrence port. The current ocean freight rate differential also suggests that from an economic standpoint a grain buyer should be willing to take delivery at Churchill if a grain price is offered at Churchill which is lower by $4.20 per tonne or more than the price at a St. Lawrence port.

Also shown on Exhibit 3.13 are the total rates via Vancouver to Northwestern Europe and to Japan. The rates to Northwestern Europe should be treated with caution as there are only a few examples of this movement published and the figures shown are for larger vessels only (more than 40,000 tonnes); however, the results are indicative of the possibilities of the use of West Coast ports for Atlantic shipments, particularly when ocean freight rates are depressed.

Exhibit 3.13 is based on the full rates paid to the railways for moving grain including the federal government's contribution to railway rates under the WGTA as well as the shipper portion. Since, under the WGTA, the federal contribution is essentially fixed, any incremental reductions or increases in railway costs for moving grain are passed along directly to the shippers and producers. Hence, the comparison including full rail rates is more relevant because 100% of the full rail rate savings available by shipping grain to Churchill instead of to Thunder Bay will accrue to Western producers and shippers as a whole.

EXHIBIT 3.13

1985 RATES FOR MOVING WHEAT FROM SASKATOON, SASK. TO NORTHWESTERN EUROPE AND JAPAN
(INCLUDING FULL RAIL RATES)

($/Tonne)

	TO NORTHWESTERN EUROPE				
	VIA CHURCHILL	VIA THUNDER BAY DIRECT	VIA THUNDER BAY & ST. LAWRENCE PORT	VIA VANCOUVER ***	VIA VANCOUVER TO JAPAN
Country Elevator	8.50	8.50	8.50	8.50	8.50
Rail Rate					
- shipper portion*	5.70	5.90	5.90	6.70	6.70
- federal contribution	20.95	21.67	21.67	24.58	24.58
- SUB-TOTAL	26.65	27.57	27.57	31.28	31.28
Terminal Elevator	8.80	7.80	7.80	7.80	7.80
Lake Transportation	-	-	16.00	-	-
Transfer Elevator	-	-	5.10	-	-
SUB-TOTAL	43.95	43.87	64.97	47.58	47.58
Ocean Freight	15.30	22.23**	11.10	14.60	18.10
GRAND TOTAL	59.25	66.10	76.07	62.18	65.68

* 1985 shipper proportion of rail rate is low reflecting substantially reduced export volumes. See Appendix A.

** includes $0.83/tonne in SLSA cargo tolls

*** in large vessels (loading over 40,000 tonnes)

It is important to note that the comparisions of total tranportation and handling charges for the alternative routes presented throughout this chapter implicitly assume that the relative prices received by the CWB for selling the same type of grain at Churchill, Thunder Bay and St. Lawrence ports closely reflect the differentials in marine transportation rates from these ports to Northwestern Europe (i.e., the price at a port equals the world price for the grain less total marine rates to the overseas export destination). If, in reality, the CWB has to offer additional discounts (in excess of the marine transportation rate differential) at Churchill (or other ports) to sell grain, the savings realized in using Churchill would be less than the amounts given in the comparisons by the amount of the additional discount. The issue of additional price discounts at Churchill is discussed further in Chapter 4.

It should also be noted here once more that there are specific transportation cost elements for movement of grain via Churchill and via Thunder Bay, some of which are included in the rates paid by Western producers (but not on a port-specific basis) and some of which are not paid for by Western producers as shippers but rather come out of general tax revenues or under other specific programs or are absorbed by the railways. Overall cost comparisons for the alternative routes taking into account these cost elements are developed in Chapter 4.

3.2.2 Comparison of Rates Under Different Ocean Freight Market Scenarios

Exhibits 3.14 and 3.15 present rate comparisons between Churchill and the alternative Thunder Bay routes under the scenarios of low, medium and high ocean freight market conditions as defined in section 3.1.6. (The routing through Vancouver to Japan has been dropped from these and further comparisons to simplify the presentation and because we are most concerned with comparative rates for export grain going east to Europe.) In making these comparisons, the assumption has been made that the factors affecting the world demand/supply of ocean vessels and hence the level of ocean rates would not also affect the rates for the other transportation/handling

EXHIBIT 3.14

RATES FOR MOVING WHEAT FROM SASKATOON, SASK. TO NORTHWESTERN EUROPE (INCLUDING FULL RAIL RATES) UNDER DIFFERENT SCENARIOS FOR OCEAN RATES

(1985 $/Tonne)

SCENARIO		VIA CHURCHILL	VIA THUNDER BAY DIRECT	VIA THUNDER BAY & ST. LAWRENCE PORT
	Country Elevator	8.50	8.50	8.50
	Rail Rate			
	- shipper portion*	5.70	5.90	5.90
	- federal contribution	20.95	21.67	21.67
	- SUB-TOTAL	26.65	27.57	27.57
	Terminal Elevator	8.80	7.80	7.80
	Lake Transportation	-	-	16.00
	Transfer Elevator	-	-	5.10
	SUB-TOTAL (to Export Position)	43.95	43.87	64.97
i) Low Market for Ocean Freight (Current Rates)	Ocean Freight	15.30	22.23**	11.10
	GRAND TOTAL	59.25	66.10	76.07
ii) Medium Market for Ocean Freight	Ocean Freight	23.20	37.33**	14.60
	GRAND TOTAL	67.15	81.20	79.57
iii) High Market for Ocean Freight	Ocean Freight	39.40	49.83	24.00
	GRAND TOTAL	83.35	93.70	88.97

* 1985 shipper proportion of rail rate is low reflecting substantially reduced export volumes

** includes $0.83/tonne in SLSA cargo tolls

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EXHIBIT 3.15

TOTAL RATES* FOR MOVING WHEAT FROM VARIOUS PRAIRIE ORIGINS TO NORTHWESTERN EUROPE
(Calculated using current exchange rate of $1 U.S. = $1.36 Can.)
(1985 $/tonne)

	CURRENT RATES (LOW OCEAN FREIGHT MARKET)			MEDIUM OCEAN FREIGHT MARKET			HIGH OCEAN FREIGHT MARKET		
ORIGIN	VIA CHURCHILL	VIA THUNDER BAY DIRECT	VIA THUNDER BAY & ST. LAWRENCE PORT	VIA CHURCHILL	VIA THUNDER BAY DIRECT	VIA THUNDER BAY & ST. LAWRENCE PORT	VIA CHURCHILL	VIA THUNDER BAY DIRECT	VIA THUNDER BAY & ST. LAWRENCE PORT
BRANDON, MAN.	61.56	60.09	70.06	69.46	75.19	73.56	85.66	87.69	82.96
DAUPHIN, MAN.	58.78	61.01	70.98	66.68	76.11	74.48	82.88	88.61	83.88
MELFORT, SASK.	56.47	66.10	76.07	64.37	81.20	79.57	80.57	93.70	88.97
SASKATOON, SASK.	59.25	66.10	76.07	67.15	81.20	79.57	83.35	93.70	88.97
MOOSE JAW, SASK.	60.17	64.71	74.68	68.07	79.81	78.18	84.27	92.31	87.58
WEYBURN, SASK.	60.63	63.33	73.30	68.53	78.43	76.80	84.73	90.93	86.20
LLOYDMINSTER, SASK.	62.02	69.80	79.77	69.92	84.90	83.27	86.12	97.40	92.67
VERMILION, ALTA.	62.48	70.72	80.69	70.38	85.82	84.19	86.58	98.32	93.59

* Including the full rail rates provided under the W.G.T.A.

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elements. This is a reasonable assumption because there is no reason why Canadian rail and elevator rates for grain should be affected by world shipping conditions and, although spot rates for lakers might increase in a buoyant ocean freight market, the CWB moves most grain in lakers at contract rates which are relatively fixed. It should be noted again that the low market scenario uses current ocean rates and hence provides equivalent comparisons to those made above in Exhibits 3.11 and 3.13. Exhibit 3.14 presents detailed comparisons for moving wheat from Saskatoon while Exhibit 3.15 presents total rates from a selection of major grain origins in the Prairie Provinces.

Exhibit 3.14 shows that in a medium market year for ocean freight, shipping through Churchill from Saskatoon would produce savings in direct shipper charges amounting to about $12.50 per tonne compared to routing through Thunder Bay and a St. Lawrence port and about $14.00 per tonne compared to routing through Thunder Bay with direct shipment overseas (all values given in this section are in constant 1985 Canadian dollars). In a high year for the ocean freight market, we estimate that Churchill would provide rate savings of about $5.60 per tonne over Thunder Bay and a St. Lawrence port and about $10.30 per tonne over Thunder Bay direct for shipment from Saskatoon. Savings in a low market year would be similar to the current savings estimated previously. It should be noted that in a low market year such as 1985, the Thunder Bay direct routing is the next most attractive alternative to Churchill in terms of direct shipper charges, but in medium and high market years the Thunder Bay routing with transshipment at a St. Lawrence port offers the next lowest rate compared to Churchill.

Looking at the marine part of the journey only, from FOB Churchill or FOB Thunder Bay to Northwestern Eruope, the average saving for the Churchill route over the next best alternative (Thunder Bay direct or via a St. Lawrence port) has been as follows for the years 1980 to 1985 (excluding 1984 when no Churchill rates were quoted):

1980	$ 5.70
1981	$12.50
1982	$16.00
1983	$11.33
1985	$ 6.93
Average	$10.67

The total rate comparisons in Exhibit 3.15 indicate that shipping through Churchill instead of Thunder Bay would result in total rate savings under all three ocean freight market scenarios for origins in a wide area significantly larger than the Churchill rail rate advantage area. Of the eight Prairie origins included in the table, only Brandon, Manitoba appears to have an overall rate advantage to Thunder Bay and even this disappears in an average ocean freight market.

All rate comparisons presented thus far have used ocean freight rates converted from reported U.S. dollar values using the late 1985 exchange rate of $1.00 U.S. equals $1.36 Canadian. To explore the sensitivity of the comparisons to a more favourable exchange rate, we have repeated the calculations for the comparative rates in Exhibit 3.15 using an exchange rate of $1.00 U.S. equals $1.10 Canadian. The new results are presented in Exhibit 3.16. The effect of a more favourable exchange rate is to slightly improve the comparison for Thunder Bay direct relative to Churchill and for Churchill relative to Thunder Bay with transshipment at a St. Lawrence port, since a more favourable exchange rate reduces the ocean freight rate differentials. Churchill again provides the lowest total rate to Europe under all ocean freight market scenarios for all origins in the table, except Brandon. The effect of a less favourable exchange rate for the Canadian dollar would be to improve the comparison somewhat for Thunder Bay with transshipment at a St. Lawrence port relative to Churchill and for Churchill relative to Thunder Bay direct, since a less favourable exchange rate increases the ocean freight rate differentials.

EXHIBIT 3.16

TOTAL RATES* FOR MOVING WHEAT FROM VARIOUS PRAIRIE ORIGINS TO NORTHWESTERN EUROPE
WITH AN EXCHANGE RATE OF $1 U.S. = $1.10 CANADIAN
(1985 $/tonne)

	CURRENT RATES (LOW OCEAN FREIGHT MARKET)			MEDIUM OCEAN FREIGHT MARKET			HIGH OCEAN FREIGHT MARKET		
ORIGIN	VIA CHURCHILL	VIA THUNDER BAY DIRECT	VIA THUNDER BAY & ST. LAWRENCE PORT	VIA CHURCHILL	VIA THUNDER BAY DIRECT	VIA THUNDER BAY & ST. LAWRENCE PORT	VIA CHURCHILL	VIA THUNDER BAY DIRECT	VIA THUNDER BAY & ST. LAWRENCE PORT
BRANDON, MAN.	58.56	55.99	67.96	64.96	68.29	70.76	78.06	78.29	78.36
DAUPHIN, MAN.	55.78	56.91	68.88	62.18	69.21	71.68	75.28	79.21	79.28
MELFORT, SASK.	53.47	62.00	73.97	59.87	74.30	76.77	72.97	84.30	84.37
SASKATOON, SASK.	56.25	62.00	73.97	62.65	74.30	76.77	75.75	84.30	84.37
MOOSE JAW, SASK.	57.17	60.61	72.58	63.57	72.91	75.38	76.67	82.91	82.98
WEYBURN, SASK.	57.63	59.23	71.20	64.03	71.53	74.00	77.13	81.53	81.60
LLOYDMINSTER, SASK.	59.02	65.70	77.67	65.42	78.00	80.47	78.52	88.00	88.07
VERMILION, ALTA.	59.48	66.62	78.59	65.88	78.92	81.39	78.98	88.92	88.99

* Including the full rail rates provided under the W.G.T.A.

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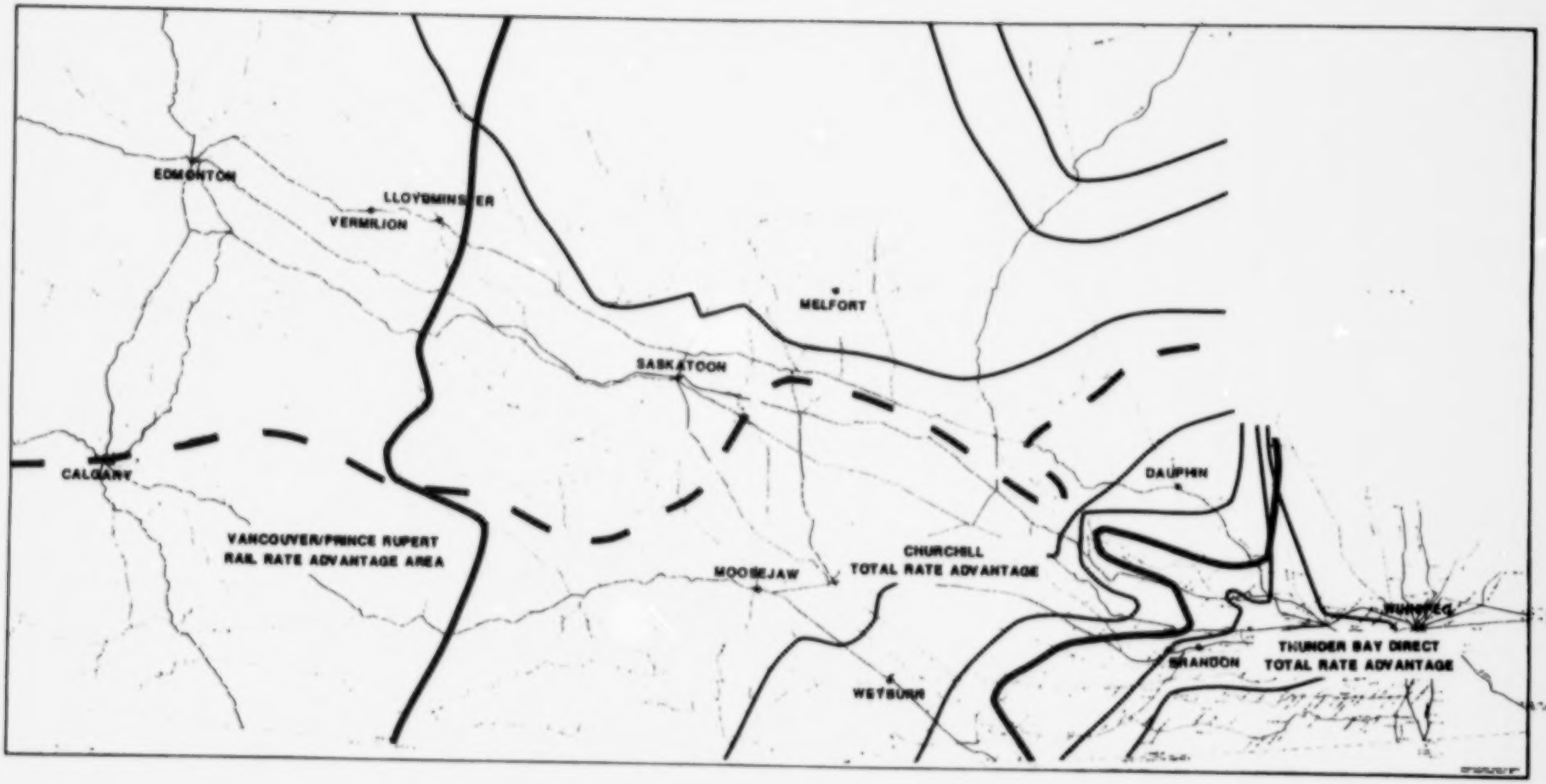
Overall, the rate comparisons of this chapter imply that in terms of rates actually paid by shippers, that is, by the Canadian Wheat Board on behalf of producers and by overseas grain buyers, it is cheaper to ship to Europe through Churchill than through Thunder Bay from a wide area of the Prairie Provinces. Exhibit 3.17 shows the extent of this Churchill total rate advantage area for the low ocean freight market scenario. This area is seen to be considerably larger than the Churchill rail rate advantage area which has historically provided the bulk (though not all) of grain shipped to Churchill. Furthermore, the Churchill total rate advantage area appears to remain large when ocean freight rates are high, although the magnitude of the savings available would be significantly less under this scenario than under the medium market scenario.


EDMONTON
LLOYDMINSTER
VERMILION
MELFORT
SASKATOON
CALGARY
DAUPHIN
VANCOUVER/PRINCE RUPERT
RAIL RATE ADVANTAGE AREA
CHURCHILL
TOTAL RATE ADVANTAGE
MOOSEJAW
WINNIPEG
THUNDER BAY DIRECT
TOTAL RATE ADVANTAGE
BRANDON
WETSUWA

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4. POTENTIAL COST SAVINGS

In the last chapter we presented a comparison of current rates charged for transporting and handling grain as it moves from the Prairies to export markets via Thunder Bay and Churchill. In this chapter we focus on how the use of Churchill for grain shipments affects the total of transportation costs in Canada and the cost of ocean freight.

It would be misleading to conclude that more grain should be shipped through Churchill simply on the basis of the rates comparison provided in Chapter 3. The current rates reflect particular approaches to cost recovery by carriers, handlers and public agencies at particular levels of throughput volume. There may be under or over recovery of costs in total, there undoubtedly is cross-subsidization of costs among routes and even among different commodities, and changes in throughput volumes would affect the rates charged. Therefore, while a comparison of current rates provides insight into the transportation costs perceived by grain shippers in terms of marginal shifts in volumes, it does not provide a complete picture.

In this Chapter we evaluate the implications on transportation system costs to grain shippers and buyers and to all Canadians of various levels of grain shipment through Churchill ranging from nil to 1.25 million tonnes per year. In doing this we make the assumption that current rates reflect an "acceptable" level of overall cost recovery for each system element with the current throughput level. (Section 4.2 describes the elements and their relevant costs.) We then evaluate, for each element of the grain handling/transportation system, the extent to which rates would have to change in order to achieve the equivalent level of cost recovery under each of the different throughput scenarios for Churchill.

4.1 BASIS OF COMPARISON

In order to evaluate the cost implications of using Churchill, the alternative route or routes and the potential volume range for Churchill must be defined.

4.1.1 Routes Considered

In Chapter 2 it was shown that most of the grain that historically has moved through the Port of Churchill has been destined to Europe. Therefore the comparison between routes has been made on the basis of a European destination for the grain and, because of the availability of marine rate information, a Northwestern European destination as defined in Chapter 3 was used.

It was also shown that the Churchill and Thunder Bay routes compete with one another, being used to move grain to many of the same destinations. Volumes of particular grain types moving through the Port of Thunder Bay generally are reduced when these same types are moving through Churchill, indicating that grain which does not move through the Port of Churchill would probably move through Thunder Bay and vice versa. Therefore we have compared the Churchill route with routes using Thunder Bay.

It was also shown in Chapter 2 that about three-quarters of the grain moving through the Port of Churchill moves from the areas on the Prairies where the rail rate to Churchill is lower than the rail rate to Thunder Bay. Accordingly, for this comparison we have selected the movement from Saskatoon which, as shown in section 3.1.2, represents the centroid origin of the grain that moves through Churchill. The rail rates from Saskatoon to Churchill are slightly lower than to Thunder Bay ($26.65 per tonne to Churchill and $27.57 to Thunder Bay in 1985/86 for a $0.92 advantage for Churchill).

4.1.2 Comparison of Volumes

The volume of grain shipped annually through Churchill has varied from about 300,000 tonnes to almost 800,000 tonnes over the last fifteen years. Primary elevator, railway and terminal elevator rates are all regulated so that, over the long term, if costs go up or down, rates should be adjusted accordingly. Given the fixed cost element in all of these oper-

ations, changes in volumes will certainly have an impact on transportation and handling rates per tonne required to recover costs. Therefore an examination of the utilization, cost recovery and rates must include a range of volumes of shipment. We have therefore examined the cost implications of various sizes of Churchill shipping programs from 250,000 tonnes to 1,250,000 tonnes per year in 250,000 tonne increments. To put the analysis of these volume options onto a common basis, we have compared each of these levels of throughput through the Port of Churchill with the zero option, the case in which no grain is exported through the Port of Churchill.

4.1.3 Comparison of Incremental Costs

Given that the purpose of this analysis is to examine impacts of changes in the way the system is operated, costs which are sunk and not recoverable are not relevant as they do not have any implications for the consequences of future actions or decisions. Therefore analyses of investment costs incurred in the past, although historically interesting, have not been included. We have therefore used expected differences in ongoing costs associated with the various volumes of shipment compared to the zero option, that is, no grain moving through Churchill.

4.2 ELEMENTS OF THE COMPARISON

To make the comparison between the two routes, each element of the grain handling and transportation system was examined in order to detect systematic cost differences between the Churchill and Thunder Bay routes.

4.2.1 Grain Collection System

Grain collection costs are associated with the amount of grain moved from the farm to the primary elevators, elevated and stored in the primary elevators and then loaded into railway cars. In general, because the grain takes the same movement channels from the farms to the primary

elevators, regardless of the port of export, there should be no changes in cost associated with a particular routing. There have been suggestions in previous reports on movement through the Port of Churchill, however, that there may be some unique costs associated with the Churchill routing when compared with other routes. These are discussed below.

- o Extra Carry-over - It has been suggested that there is an additional carry-over of grain created by the Churchill shipping program (that is, extra inventory which, because of the timing of the Churchill shipping season, is carried over from one crop year to the next) either in the primary elevators or on the farm. An examination of the grain movement patterns, as described in Chapter 2, shows that movement of grain to Churchill is coincident with a decline in the movement of grain to other ports, mainly Thunder Bay, during the Churchill season, so that there is no overall increase in shipments. Generally, peak system movement occurs in the months of May and June prior to the Churchill shipping season. Since there is no extra movement caused by the Churchill program and deliveries by producers are unlikely to be affected in general, it was concluded that there is no net additional carrying of inventory on an overall basis, in the primary elevators or on the farms, created by the existence of the Churchill program.

- o Reduced Shipment of Other Grains and Grain from Other Areas - There has also been some suggestion that, when the Churchill program is operating, it has been difficult to ship other grains from primary elevators involved in the Churchill program. Discussions with grain shippers produced no evidence of this as a general occurence. The Churchill movement is only a very small portion of total movement, even during the Churchill season, and therefore there should be sufficient capacity at most elevators to load cars for both Churchill and other destinations.

- o Loading of Boxcars - Under current operating conditions the Churchill route can accept only boxcars, not the larger covered hopper cars used on other routes in the system in combination with boxcars. Because of their physical configuration, boxcars are more difficult than hopper cars for primary elevators to load, require more cleaning (by the railways) and require the mounting of wood and cardboard grain doors on the inside of the

sliding boxcar doors. The extra time needed to "cooper" (mount the grain doors) and to load a boxcar varies depending on the loading rate of a particular primary elevator. Valuing total operator costs at $15 per hour and using estimates of loading time received from a major grain company results in estimates of the additional costs for loading boxcars of between $0.10 and $0.15 per tonne. The cost of loading the boxcar is borne by the primary elevator but the railways are responsible for any extra cleaning of the cars required and for supplying grain doors; these railway costs are intended to be covered by the railway rates and are discussed later in this chapter. Of course, these costs are incurred if boxcars are loaded to any destination. There would be, therefore, costs relating solely to Churchill only if extra boxcars are maintained in the fleet and used because of the Churchill movement. This subject is discussed in more detail later when rail car requirements to serve Churchill are considered.

This review of the costs of the grain collection system for movement through Churchill and through Thunder Bay indicates that different levels of use of the Port of Churchill should not affect primary elevator costs unless additional boxcars are required for this movement. If this is the case, grain handling rates would have to increase sufficiently to generate additional revenues of $0.15 per tonne times the tonnes loaded into these additional boxcars.

4.2.2 Rail Transportation System

Under the Western Grain Transportation Act (WGTA) the railways are compensated for the movement of grain through the rates which are paid by the shippers and by the federal government. The actual steps used to set these rates are as follows:

- the Canadian Transport Commission (CTC) estimates total costs for the forthcoming year, based on a set of movement forecasts;

- rates for the movement of grain are then set on the basis of a multiplier times the original Crows Nest Pass Rates;
- the federal government contribution in total is established through the mechanism described in the WGTA;
- the shippers' share is calculated as what is required after the Federal contribution is deducted;
- the rates are then published and the shipper and government shares are paid on an on-going basis over the year.

The CTC acts as an arbitrator in determining what the actual railway costs are according to a set of principles outlined in the WGTA. The principles relevant to this analysis include:

- railway costs can be separated into line related costs which vary only with the length of the lines that are maintained in operation and movement related costs which vary with the volume of grain moved;
- grain rates should cover all movement related costs associated with grain;
- line related costs need only be included in the rate-base on "grain dependent branch lines".[1] On main lines, line related costs should be covered by other traffic;
- included in the rate is a contribution to the overhead of the railways which is based upon a percentage of the other costs.

As described above, the railway rates are set as multiples of the original Crow's Nest Pass rates which essentially were structured in 1898. Rates vary only with the distance travelled; or more specifically, with the distance to the nearest of either Thunder Bay or Vancouver. Exhibit 4.1

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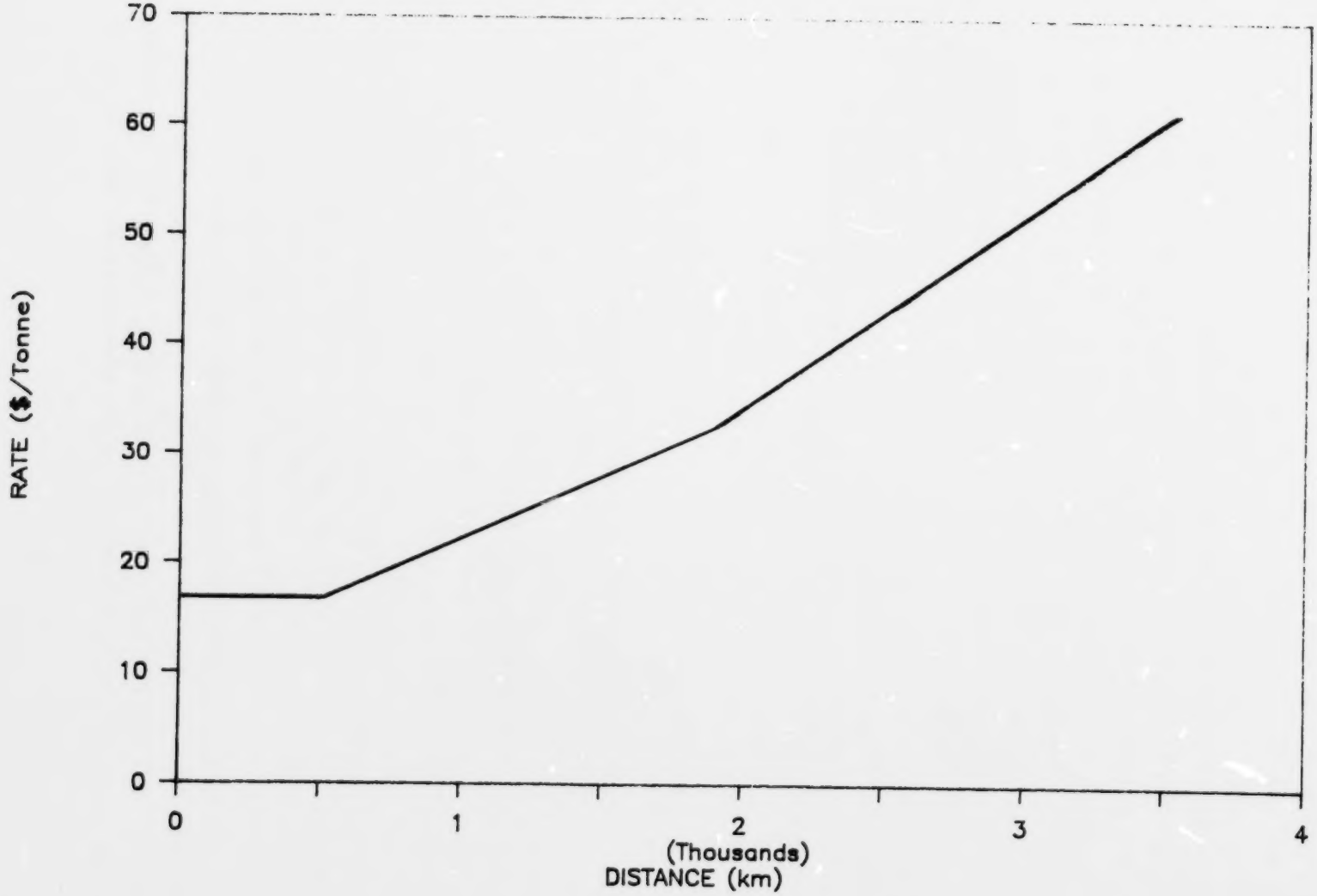
1. A grain dependent branch line is defined as a rail line on which grain constitutes 60 percent or more of the traffic originating or terminating on the line. Lines so designated are eligible for branch line rehabilitation subsidies from the federal government.

EXHIBIT 4.1

1986 GRAIN RATES



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shows the 1985/86 grain rates, showing the total rate paid by distance, including the federal contribution. Although the CTC ensures that the railways are compensated in total for movement of grain, there is no effort to ensure that the costs of any specific movement are fully compensated or even that the way in which rates vary with distance reflect variation in costs. Costs beyond these covered in the rates for specific movements could result from factors such as:

- o difficult topography such as mountainous areas on routes to the West Coast;
- o additional switching required in terminal areas such as Vancouver and Thunder Bay;
- o additional cost of separating out and providing boxcars for services on load restricted branch lines;
- o additional costs of separating out and providing boxcars for service on the Churchill route;
- o additional car cycle times on longer routes such as to Prince Rupert;
- o mobilization of staff at the beginning and end of the shipping season to seasonal ports such as Thunder Bay and Churchill;
- o the advantages and disadvantages of being able to carry grain in combination with large flows of other commodities, as can be done to Thunder Bay and Vancouver but not to Churchill.

The nature of the railway cost information available and the high incidence of fixed cost elements in the railway cost structure make it very difficult to attribute costs to particular movements. Basically the position must be that the WGTA has specified that the railways receive compensation in total for grain movements and that the distance based railway rates charged under the WGTA reflect these costs in an adequate manner in general. The only alternative would be to conduct a very detailed enquiry into the costs of various routes which would have to be much larger in

scope than previous studies of railway grain movement such as the Hall and Snavely enquiries.

The current WGTA railway rates for the movement of grain from Saskatoon are $26.65 per tonne to Churchill and $27.57 per tonne to Thunder Bay, resulting in an advantage for the Churchill route compared with the Thunder Bay route of $0.92/tonne.

There are some specific costs associated with use of the Churchill line, however, which can be quantified and are not specifically covered in the Churchill rates; rather, they are borne by all grain shippers and perhaps by shippers of other commodities as well. These costs must be evaluated because their level will change depending on the level of use of Churchill for grain shipment and on whether or not the rail line to Churchill is kept in operation. These occur because of the characteristics of the Churchill line.

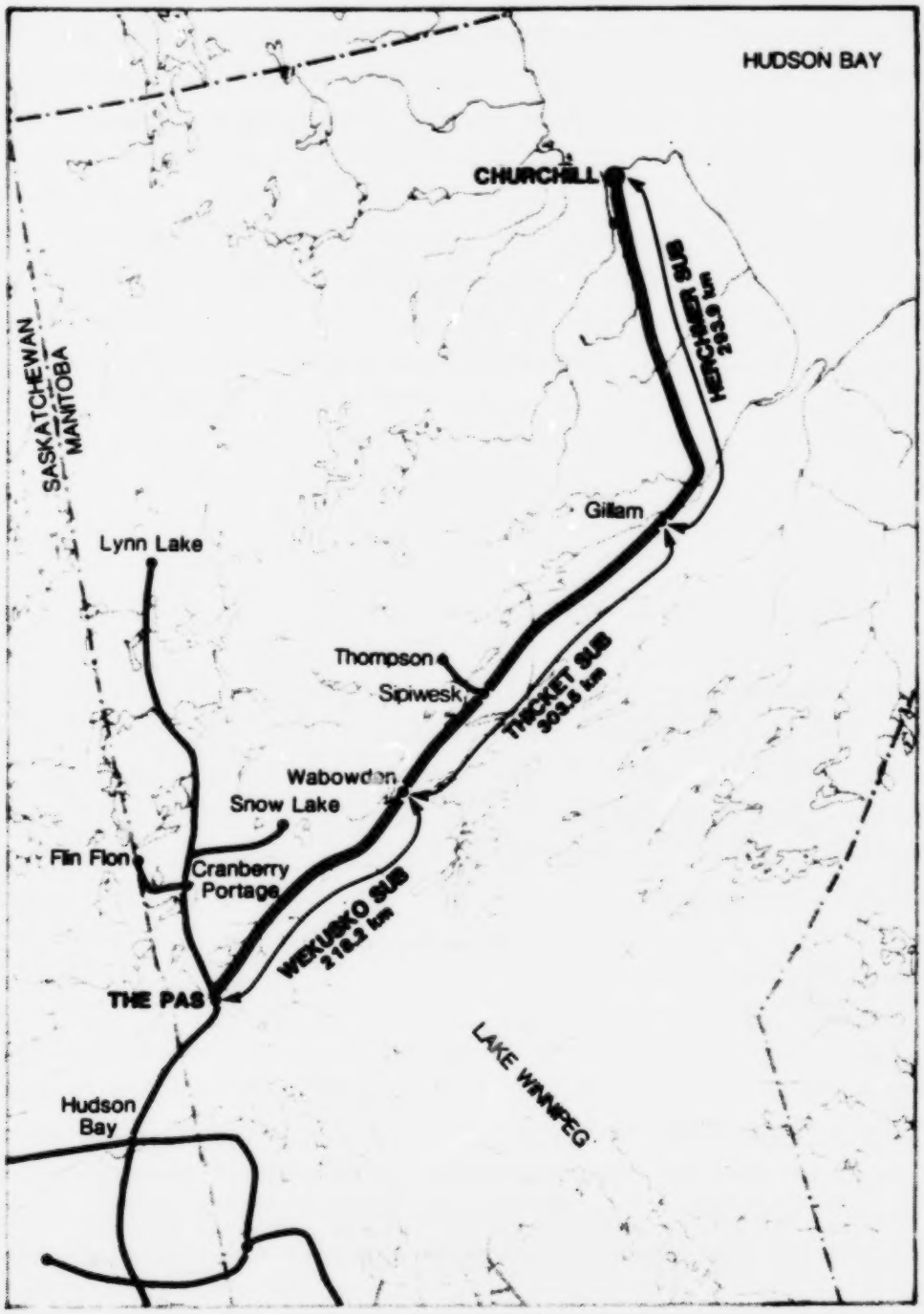
Attribution of Line Costs

The Churchill route is different from other grain export routes in that the line to the Port carries mostly grain and, in fact, the most northerly subdivision on this line (the Herchmer Subdivision) has been declared a "grain dependent branch line" by the CTC. Exhibit 4.2 shows the railway line involved. This situation is unique to Churchill. The routes to all of the other grain ports are not "grain dependent branch lines" and their line related costs are not included in the WGTA cost base. The line related costs which might be attributed to grain shipment through Churchill but are not specifically included in the Churchill rate have three elements:

- the line related costs of the Churchill line beyond those of other "grain dependent branch lines". For the current crop year the CTC has given an annual grant, out of federal government WGTA funds, of $680,000 to CN for the additional costs of the line from Sipiwesk

exhibit 4.2

CHURCHILL RAILWAY SYSTEM



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which is also known as Thompson Junction (where most other CN traffic turns off) to Churchill. Thus, this grant includes the extra line related costs of the Herchmer Subdivision and part of the Thicket Subdivision, beyond the average line costs of grain dependent branch lines;

- the remaining line related costs of the Herchmer Subdivision which are included in the WGTA rate base. According to the CTC, average line related costs for grain dependent branch lines amount to some $12,698 per mile of line per year and therefore for the Herchmer subdivision are approximately $2,281,000 per year. Although these costs are specific to the Churchill route, they are being paid by all grain shippers and by the federal government through the mechanism of the WGTA rate setting system. The cost would be saved only if the line were abandoned. If the Churchill line were no longer used for grain but were kept open for other uses, these line related costs would no longer be allocated to grain shippers but would have to be absorbed by CN, the federal government and/or other users;

- the line related costs associated with operation of the section of the Thicket Subdivision from Thompson Junction (Sipiwesk) north to Gillam. Except for the additional costs addressed in the first point above, these are treated in the same way as the costs of other main lines and are not allocated specifically to grain shippers. Using the same per mile estimate of costs ($12,698) these amount to approximately $1,657,000 in 1985/86. The line would have to be abandoned for all traffic before these could be saved. This section of the Thicket Subdivision serves Gillam, currently the site of much construction activity associated with the building of the Limestone Generating Station. This activity is likely to continue with the subsequent construction of the Conawapa power project.

There are therefore three line related cost elements associated with the use of the Churchill line which could be saved by abandonment of the line:

- $680,000 which is a special subsidy paid out of WGTA funds for additional line related costs of the line from Thompson Junction north;

- o $2,281,000 for the basic line related costs of the Herchmer Subdivision which is included in the WGTA cost base as a grain dependent branch line and therefore is paid by all grain shippers and the federal government;

- o $1,657,000 for the northerly section of the Thicket Subdivision now paid by CN and other shippers.

The first two of these cost elements are paid out of WGTA funds that come from the federal government and grain shippers. They are not specifically charged to any particular movement but are added to the general rate base and therefore increase all grain rates. In 1985/86 the rate base is increased by $2,961,000 and, if 30 million tonnes of grain are shipped under the statutory rates, then these allowances will increase the average rate for all grain by approximately $0.10 per tonne. The $1,651,000 for the northerly section of the Thicket Subdivision is paid by CN and presumably this is passed on to the shippers of all commodities on the CN Rail system.

Higher Rail Volume Related Costs on the Churchill Line

CN has also claimed a special subsidy, out of the WGTA funds provided by the federal government, for higher volume related costs associated with the Churchill line than on other routes, amounting to $740,000 for the 1985/86 crop year. CN suggests that these are due to special circumstances associated with the Churchill line such as the use of smaller locomotives, longer length trains, extra fuel consumption, etc. As most of these costs are included in the WGTA rate base, they are already being paid by grain shippers in total and by the federal government. Increased rates to cover this are therefore being received by both CN and CP. CN would prefer that a specific subsidy be provided for the operation of the Churchill line, in the same way that these are provided for the line related costs of the Churchill route. The CTC ruled that they are not empowered to grant such a subsidy under the Western Grain Transportation Act.

If some of these costs might be saved by the reduction or elimination of the use of Churchill for grain operations, they represent a potential saving for grain shippers. Most of these costs are associated with the requirement to use boxcars only on the Churchill line, and therefore they are included in the analysis of costs associated with the different car requirements of the Churchill route and are discussed under the next heading.

Special Car Requirements

At the current time, conventional hopper cars are not allowed on the Churchill route because of the problem of settlement of the line in perma-frost areas which might cause derailments for the long wheel base hopper cars, particularly when they are empty. At present, this is not an issue as there are sufficient boxcars in the system to handle Churchill requirements as well as requirements of the branch lines which are restricted to lighter loads. In the future, as the number of boxcars available decreases, one of three actions will be required to assure that operation of the Churchill line can be maintained:

- rehabilitate additional boxcars. In this case, there will be an additional capital cost as well as additional operating costs associated with movement of these boxcars;
- purchase specialized equipment for the Churchill route such as the articulated hopper car that has been developed and a prototype of which is now being tested on the Churchill line by CN; a report on this is expected during the spring of 1986. There will be some additional operating costs associated with this option compared to the use of conventional hopper cars;
- refurbish the Churchill line so that conventional hopper cars can move on this route. CN is currently surveying the requirements for stabilization of the line.

A more complete discussion of this issue is included in Appendix E. This Appendix indicates that the use of the Churchill line will impose

costs on the railway system in the future due to the use of special cars or the need to refurbish the line. The basic conclusion of Appendix E is that, given the current boxcar supply and use, including the potential availability of CP boxcars for the Churchill movement, there are no such additional costs associated with the movement for the next few years. Before 1991/92, however, actions will have to be taken in order to maintain operation of the Churchill line. If the action taken is to rehabilitate additional boxcars or to acquire other special cars, these additional cars will be used during other times of the year on other services and will incur additional costs compared with conventional hopper cars.

The number of additional cars required depends upon the size of the Churchill program. The estimated additional annual costs in 1991/92 and beyond expressed in 1985 dollars associated with purchasing and operating additional boxcars or articulated hopper cars for different levels of throughput are as follows:

Size of Churchill Program (thousand tonnes)	Additional Annual Costs - Articulated Hopper ($ million)	Additional Annual Costs - Boxcars ($ million)
250	$0.765	$0.776
500	1.529	1.556
750	2.293	2.332
1,000	3.058	3.109
1,250	3.823	3.888

Because of the lack of experience with building and operating articulated hopper cars, the costs associated with these cars cannot be accurately estimated. As explained in Appendix E, the estimates of operating costs made and used in the above table for articulated hopper cars are probably on the high side whereas the estimates of capital costs may be on the low side. A more complete study of this subject is currently being done by Transport Canada and CN, with results expected to be available during the spring of 1986.

In order to ascertain the best approach to enabling continued use of the Churchill line in the long run, additional costs associated with special cars should be compared with the potential costs of refurbishing the line to carry conventional hopper cars. This would have an annualized cost estimated to be between $2 and $4 million per year, depending upon the actual cost of refurbishment of the line (although higher costs have also been mentioned). The cost of line refurbishment is being evaluated in more detail by CN.

If the line is not refurbished, the car associated costs will have to be paid for by some combination of the grain shippers (by inclusion of the costs in the WGTA rate base), the federal government and the other participants in the grain system who have bought or leased cars in the past. The actual distribution of these costs would depend on how the cars would be purchased and operated. The costs of line refurbishment presumably would have to be met by a combination of shippers and the federal government.

Summary of Railway System Cost Elements

Exhibit 4.3 presents a summary of the railway system cost savings associated with different levels of shipment through the Port of Churchill in 1986/87 and in 1991/92. These are compared with the zero option, that is, no movement of grain through Churchill.

There is currently a rate saving associated with movement to Churchill compared to Thunder Bay which may or may not reflect actual cost differentials. Based on the current rate advantage and the current WGTA rate structure this amounts to approximately $0.92 per tonne and is reflected in the first line of Exhibit 4.3.

This rate saving is much less than the increased costs that would be incurred if new cars have to be acquired and operated specifically because of the Churchill movement or if the line has to be refurbished to

EXHIBIT 4.3

RAILWAY SYSTEM COST SAVINGS
ASSOCIATED WITH THE CHURCHILL ROUTE
(1985 $000's)

	SIZE OF CHURCHILL PROGRAM				
	250,000 tonnes	500,000 tonnes	750,000 tonnes	1,000,000 tonnes	1,250,000 tonnes
Advantage with Existing Rates	230	460	690	920	1,150
Car Associated Volume Related Costs*	-765	-1,529	-2,293	-3,058	-3,823
Line Related Rail Costs**	-4,618	-4,618	-4,618	-4,618	-4,618
System Cost Savings 1986/87	-4,388	-4,158	-3,928	-3,698	-3,468
System Cost Savings 1991/92	-5,152	-5,687	-6,221	-6,756	-7,291

* Based upon estimates of capital and operating costs of new, articulated hopper cars on the Churchill line which will be required only when the existing boxcar fleet experiences sufficient attrition to require new cars to be purchased for Churchill service. See Appendix E for details.

** Assumes all line related costs from Thompson Junction to Churchill assigned to grain.

accept conventional cars. In Exhibit 4.3 the cost of the least expensive of the three options investigated (rehabilitate boxcars, acquire articulated hopper cars and refurbish the line) is included: that is, acquiring articulated hopper cars. It should be recognized, as discussed more fully in Appendix E, that this is based on available cost and performance information; the results are preliminary and may be changed as better data becomes available. It is possible that both the articulated hopper and line refurbishment options will be found to be more expensive than the option of rehabilitating boxcars, at least for the next decade or so. For purposes of the economic comparison of Churchill and Thunder Bay grain movements, the impact of such an outcome would be small since the annual costs of the boxcar rehabilitation option, as shown in the table on page 4-12, are very similar to the estimates for the articulated hopper option. As discussed previously, additional cars will not be required until there has been considerably more attrition of the existing grain boxcar fleet. Additional cars will be required by 1991/92 according to GTA projections of the attrition rate of the existing boxcar fleet.

As discussed above, there are also line related costs associated with keeping the line to Churchill open, most of which are now attributed to grain shippers. The line related costs cannot be saved unless the line itself is abandoned although if the line is kept open they could be paid from other sources (e.g., government accounts more general in nature than those earmarked for grain transportation). The costs shown in Exhibit 4.3 include the line related costs for the whole line from Thompson Junction north although CN now pays the cost for the first section, from Thompson Junction to Gillam.

As shown on Exhibit 4.3, use of the Port of Churchill creates higher rail system costs, with the total increasing when new cars have to be acquired because of the existence of the Churchill shipping program.

4.2.3 Port and Terminal Facilities

Port and terminal elevator charges are intended to achieve overall cost recovery. In general the elevators at Thunder Bay have been granted rates by the Canadian Grain Commission to make themselves self-sustaining. Similarly the Lakehead Harbour Commission which operates the port at Thunder Bay levies charges to recover its costs. Exhibit 4.4 shows that the Port of Churchill which includes the elevator operation has also been self-sustaining in most years since 1981, receiving sufficient revenues from the rates and fees charged to pay operating and remaining capital charges. Since 1980, however, the Port has not paid interest charges on a substantial portion of its capital investment. It might, therefore, be suggested that this is a cost not included in rates associated with the movement through the Port. However, similar relief was provided in 1980 to other ports (e.g., Halifax, Thunder Bay, Prince Rupert and Sept Iles). In addition, other government-aided developments of infrastructure such as the St. Lawrence Seaway Authority and, indeed, CN have not paid full interest charges on their original capital cost. The interest foregone by the federal government has not been included as an extra cost associated with Churchill because of the existence of similar interest costs foregone on other parts of the Canadian marine and rail transportation system.

This analysis has concentrated on the exten to which costs depend on the level of grain shipment through Churchill. In the long run these cost changes would be reflected in rate changes, both in Churchill and Thunder Bay.

Terminal Elevator Costs

An analysis was undertaken of the extent to which terminal elevator charges would vary with volume in Thunder Bay and in Churchill. The 1984 report on the use of Churchill, sponsored by the Western Grain Elevator Association, ("Churchill as an Outlet for Prairie Grain", Canada

EXHIBIT 4.4

PORT OF CHURCHILL REPORTED NET INCOME, 1970 - 1984

YEAR	NET INCOME (Loss) ($'000s)	GRAIN VOLUME ('000s tonnes)
1970	(283)	670
1971	(453)	667
1972	(824)	636
1973	(1,003)	462
1974	(995)	498
1975	(1,241)	506
1976	(2,332)	719
1977	(6,109)*	755
1978	(377)	543
1979	(577)	537
1980	(1,956)	290
1981	578**	438
1982	667	557
1983	844	621
1984	(1,137)	436

* Reflects a special depreciation charge of $6,481,597 to cover accumulated depreciation cost of dredging.

** In 1980, Treasury Board wrote off the cost of outstanding loans to Churchill such that interest payments on the loans have not been required since 1981.

Grains Council, May 1984) estimated that approximately 60 percent of the total grain elevator costs in Thunder Bay were fixed and 40 percent were variable with throughput. Therefore, with total shipper paid elevator and port revenues estimated at $7.80 per tonne at Thunder Bay, we estimate that there is a marginal cost reduction of $3.12 for every tonne of grain that is removed from Thunder Bay.

At Churchill the variation of costs with volume was analyzed by examining the financial results over the last several years and determining how costs varied with throughput. Correcting for inflation it was noted that the fixed costs, in 1985 dollars, were about $4.88 million per year and the variable costs $3.04 per tonne. Since the variable costs were very similar to those experienced at Thunder Bay it was concluded that for every tonne of grain switched from Thunder Bay to Churchill or vice versa there are offsetting marginal cost savings and expenditures in the two ports.

The main difference is that, if Churchill is kept open, the fixed costs of operation in Churchill must be covered at all levels of throughput; at Churchill most of these fixed costs could be saved if there were no grain shipping program. As discussed above, fixed costs were estimated at $4.88 million in 1985 dollars. Not all of this could be saved, however, if the Port of Churchill were no longer in use for grain movements. Some of it represents depreciation on sunk investment in facilities and equipment. Our estimate is that the avoidable fixed costs of operating the Port of Churchill for grain are $3.41 million per year. These costs are currently paid through the rates but would be avoided if no grain were shipped through Churchill. An explanation of this logic is included in Appendix C.

Essentially the facilities at Thunder Bay have to be constructed to handle the throughput at the peak time of the year and would be required at all scales of shipping programs in Churchill. Therefore there is no fixed cost element which might be affected by the scale of the Churchill program.

In addition to current terminal and Port operating costs it has been suggested that there are several other costs which are not covered by

current rates at Churchill but that should be included in an evaluation of the cost of continuing to ship grain through the Port and for which there are not corresponding costs in other ports. A discussion of each of these subject areas follows.

Extra CGC Inspection Costs

The Canadian Grain Commission provides staff to inspect grain in Churchill and in other grain ports. These staff are provided with living allowances and accommodation in Churchill because of the remote location and because of the relatively short season. In addition there are extra transportation and communications charges. For 1985/86, the additional costs associated with Churchill have been estimated by CGC staff to be $50,000 and to be fixed over a relatively broad range of volumes of grain. These were accepted as being an additional cost of Churchill operation which is not covered by current rates and which could be saved if Churchill operations were terminated.

Unloading of Boxcars

At the present time the elevator at Churchill is essentially equipped to unload only boxcars. This may cause increased costs compared with the mix of hoppers and boxcars experienced at other elevators but these have been included in the current rates for Churchill. In the future, if substantial volumes of grain are carried by hopper cars to Churchill, it may be necessary to modify the unloading pits. This additional capital cost may or may not be offset by reduced operating costs for the unloading facility; experience at the various terminal elevators suggests that it would be. Therefore we have not included any additional cost element for this factor.

Overtime Charges for Elevator

When the elevator is required to operate overtime in order to complete the loading of a vessel, the ship's agent is charged $540 per hour

for this additional work at Churchill. Depending upon the specific agreements among the seller (the Canadian Wheat Board), the buyer and the shipowner, some of this amount may be charged back to the CWB. Normally these overtime charges are the responsibility of the shipowner since they may be incurred in order to increase the speed of loading and thereby reduce the shipowners' operating costs. In 1985 two ships calling at Churchill were chartered by the CWB directly and any additional overtime charges associated with loading these ships may have been passed on to the CWB.

The study team has investigated the magnitude of these costs and found that they were fairly small. In addition, since these are normally the responsibility of the purchaser and/or the shipowner and since they are also incurred at other ports, no allowance for these costs has been included in this analysis.

Capital Cost of Future Improvements

There are capital costs associated with several future improvements to the elevator and Port of Churchill which may or may not represent additional costs that should be included in the comparison of routes. These are discussed below:

- new tug: A new tug has recently been ordered for the Port of Churchill at a total cost of some $2.7 million. The operating and capital costs of the existing tug have been included in the rates charged. As the operating costs of the new tug are expected to be considerably lower than those of the existing tug, the increased capital costs of the new tug may be offset by reduced operating costs. In addition, if the use of the Port for grain were curtailed, this tug could be used at other locations. Therefore, we have not included any additional costs associated with the purchase of this new tug in our estimates;

- dust control: To conform with current employment standards and health regulations, approximately $5 million will have to be invested in dust control equipment for the Churchill elevator. With a 30 year life and an

11% interest rate this works out to an annual cost of $575,000 per year. This is essentially a fixed requirement at any level of throughput and could be saved only if the elevator were no longer to be used. To a considerable extent this cost has already been incurred in Thunder Bay and included in the rates. Therefore this cost of staying in business at Churchill has been included in our estimates;

- o additional dredging and construction of a new shipping gallery: Maintenance dredging is an ongoing cost of operation in Churchill and in other ports and should be reflected in operating costs and charges. In addition, however, a deepening of the berths and the construction of a new loading gallery have been proposed to reduce loading delays and to enable larger ships to be loaded in the port. Since the additional capital cost would be justified on the basis of reduced elevator operating costs and of lower ocean freight rates for the marine part of the journey and we are examining total movement costs, this potential cost element has not been included.

Overall Comparison of Port and Terminal Systems

Exhibit 4.5 summarizes the incremental cost of continuing to ship grain through the Port of Churchill. It can be seen that there are three additional cost elements associated with any level of use of the port. These add to a total of approximately $4 million per year.

4.2.4 Marine Transportation System

The major benefits associated with using the Port of Churchill are the savings expected on the marine portion of the voyage. Chapter 3 develops the marine rates for shipping grain to Northwestern Europe by three routes: via Churchill, via Thunder Bay through direct shipment by ocean vessel and via Thunder Bay by lake vessel to the St. Lawrence and then transshipment to an ocean vessel in the St. Lawrence. The Churchill rate is the lowest for all three market scenarios for ocean freight rates.

EXHIBIT 4.5

PORT SYSTEM COST SAVINGS
ASSOCIATED WITH THE CHURCHILL ROUTE
(1985 $000's)

	FOR ALL SIZES OF CHURCHILL PROGRAM
Extra CGC inspection costs	-50
Fixed costs associated with Churchill elevator	-3,410
Annual cost of investment in dust control system for Churchill (to be incurred in future)	-575
TOTAL SYSTEM COST SAVINGS	-4,035

Application of these rates to the various throughput scenarios for Churchill may not fully reflect the effects of these scenarios on Canadian transportation costs. In the following subsections we consider possible adjustments to the marine rate savings.

Marine Rates

The major portion of marine costs are made up of marine freight rates. Under the Canadian Wheat Board's present system of sales the foreign buyer is normally responsible for these costs. However, the marine rates will have an impact on the price that the Board will realize FOB the Canadian port and therefore should be included in the overall comparison.

In a "perfect" market situation the difference in the price of grain between ports should fully reflect the difference in marine transportation costs; that is, Churchill grain should be sold at a discount with respect to the lower St. Lawrence ports but at a premium compared to Thunder Bay. We were informed that in some circumstances the Churchill discount compared with the St. Lawrence ports can be greater than the difference in marine rates would justify because of the reluctance of some buyers to take delivery at Churchill. The extent to which this occurs will be limited by the willingness of other merchandisers of grain to take delivery at Churchill (paying the discounted price) and resell the grain at a price reflecting actual market conditions. In addition, some countries with state shipping lines may prefer to absorb some of the higher marine costs to Churchill to keep their vessels busy. In the following analysis, therefore, we have included the full amounts of the marine freight rate differentials as potential benefits to Canadian grain shippers.

The marine freight rates used in the comparison are those to Northwestern Europe as, for reasons explained in Chapter 3, these rates were available and are representative of the rates for grain from Churchill. The differences in rates from Churchill and from the St. Lawrence system to Northwestern Europe should be representative of the rate differ-

entials to many other points in Northern Europe; for example, vessels travelling to Baltic ports have to pass close to the Antwerp/Hamburg ports used in the comparison. There may be an additional advantage associated with Churchill for voyages to more northerly points (e.g., Stavanger, Norway) and less of an advantage for more southerly points (e.g., Mediterranean ports). Appendix G examines the possible rates to a Mediterranean port. As described in Chapter 2, a high proportion of Churchill grain moves to Northwestern Europe and to Baltic ports.

St. Lawrence Seaway Tolls

For the routes via Thunder Bay, included in the total marine cost are tolls charged for use of the facilities of the St. Lawrence Seaway Authority (SLSA). Since the costs of operation of the Seaway are essentially fixed for all levels of traffic, each tonne of grain that is transferred from the Seaway route to the Churchill route means a loss of net revenue for the Seaway which would have to be made up in some other way and for which there is no compensating cost saving. Conversely, each additional tonne of grain moved through the Seaway represents an increase in Seaway revenue without a net increase in costs. Therefore, the reduction in Seaway revenue at existing rates should be deducted from the potential marine cost savings associated with using the Churchill marine route. The total tolls for ocean vessels and for lakers were estimated at $1.38 per tonne and $1.18 per tonne of cargo respectively including tolls paid by the shipper/buyer (cargo tolls) and by the shipowner (GRT tolls and lockage fees). The higher figure for the ocean vessel occurs because of the lower cargo tonnage carried per Gross Registered Ton and per lock transited on ocean vessels, and on which basis tolls are collected.

Additional Transport Canada En Route Costs

There are also Transport Canada (mostly Canadian Coast Guard) costs associated with operation of the Hudson Bay route including such things as the use of ice breakers, search and rescue facilities, ice surveillance, radio stations, etc. and it has been maintained by some that

these costs should also be included in any comparison. It should be pointed out, however, that other routes also use the resources of Transport Canada. To name just a few, ice breakers are needed on the St. Lawrence at certain times of the year; a very complex system of marine traffic control centres has recently been put in place for the St. Lawrence and Vancouver, etc. It is also very difficult to state which of these costs might be saved or reduced if Churchill were no longer used for grain. Therefore the study team judged that these costs should not be included in the evaluation of the costs associated with Churchill.

Comparison of Marine Rates

The net marine rate saving of the Churchill route over the two possible Thunder Bay routings are provided on Exhibit 4.6. These are the marine rate differentials net of the SLSA tolls as described previously. Because of the substantial variation in ocean freight rates in different time periods, the three different market scenarios are carried forward for the subsequent analysis. In general, the lower saving associated with Churchill for each market scenario is carried forward but for the low ocean freight market scenario two routings are carried forward:

- Thunder Bay direct as this represents the lowest cost possibility under this market scenario and could be used for the marginal amounts of grain that might be transferred to or from Churchill;
- Thunder Bay and St. Lawrence Port as this is the way by which most CWB grain moves, even in periods of low ocean freight rates.

4.3 OVERALL ROUTE COMPARISON

In the previous section of this chapter the savings associated with each portion of the entire grain transportation system were estimated. In this section these system component savings are combined to provide estimates of the overall net transportation cost savings that could be

EXHIBIT 4.6

MARINE SYSTEM COSTS AND SAVINGS
ASSOCIATED WITH THE CHURCHILL ROUTE
($/tonne)

SCENARIO	VIA CHURCHILL	VIA THUNDER BAY DIRECT*	VIA THUNDER BAY AND ST. LAWRENCE PORT**	CHURCHILL SAVING	
				COMPARED WITH THUNDER BAY DIRECT	COMPARED WITH THUNDER BAY AND ST. LAWRENCE PORT
Low Market for Ocean Freight	15.30	22.23	32.20	5.55	15.72
Medium Market for Ocean Freight	23.20	37.33	35.70	12.75	11.32
High Market for Ocean Freight	39.40	49.83	45.10	9.05	4.52

☐ Cost savings carried forward for comparison

* Includes estimated $1.38/tonne in SLSA tolls which would not be saved by the transport system through a transfer to the Churchill route.

** Includes estimated $1.18/tonne in SLSA tolls which would not be saved by the transport system through a transfer to the Churchill route.

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realized through use of the Port of Churchill. As noted earlier, this comparison makes the implicit assumption that all of these cost savings can be realized to the benefit of Canadians; in particular, it assumes that ocean freight rate savings will be reflected in the grain prices realized at the various ports.

Exhibits 4.7 through 4.10 show the overall net savings in 1986/87 and 1991/92 associated with Churchill grain programs of different sizes relative to no shipment of grain through Churchill. There are two exhibits for each year because of the need to show alternative treatments of line related railway costs. At present some of these are paid out of monies ear-marked for assistance to grain through the Western Grain Transportation Act. Others are borne by shippers in general. Savings of line related costs would be made only if the rail line were abandoned as well as not being used for the movement of grain. This has implications for other traffic using the line including passenger services, Churchill and Arctic resupply activities and other activities related to Northern development, sovereignty and defence. Exhibits 4.7 and 4.9 assume that the line related costs would not be saved even if no grain moved through Churchill because the line would remain in operation for other purposes. Exhibits 4.8 and 4.10 assume that the line related costs would be saved if Churchill were closed for grain operations since the rail line would be abandoned.

All of the costs shown on Exhibits 4.7 through 4.10 are paid for by the grain transportation system, that is the federal government (out of WGTA funds) and ultimately the grain producer, with the exception of the portion of the railway line related costs now paid by CN ($1,657 thousand for the section of line from Thompson Junction to Gillam).

In 1986/87 (Exhibits 4.7 and 4.8), new cars will not be required to continue operation to Churchill; therefore no car related costs are included. Since new cars or other steps will be required to serve the Churchill route by 1991/92 (Exhibits 4.9 and 4.10), new car costs are included for 1991/92, based on the use of articulated hopper cars for reasons presented earlier in sub-section 4.2.2.

EXHIBIT 4.7

OVERALL SYSTEM SAVINGS
RELATIVE TO NO GRAIN MOVEMENT THROUGH CHURCHILL
EXPECTED WITH THE CHURCHILL ROUTE
IN 1986/87 NOT INCLUDING RAILWAY LINE COSTS
(1985 $000's)

	SIZE OF CHURCHILL SHIPPING PROGRAM				
	250,000 tonnes	500,000 tonnes	750,000 tonnes	1,000,000 tonnes	1,250,000 tonnes
Railway System Cost Savings					
- Rate Advantage	230	460	690	920	1,150
- Car Associated Volume Related Costs	-	-	-	-	-
- Line Related Costs	-	-	-	-	-
Port Cost Savings	-4,035	-4,035	-4,035	-4,035	-4,035
Marine System Cost Savings					
- Low Market Scenario: compared with Thunder Bay direct	1,388	2,775	4,163	5,550	6,938
- Low Market Scenario: compared with Thunder Bay and St. Lawrence	3,930	7,860	11,790	15,720	19,650
- Medium Market Scenario	2,830	5,660	8,490	11,320	14,150
- High Market Scenario	1,130	2,260	3,390	4,520	5650
Total - Low Ocean Freight Market Scenario: compared with Thunder Bay direct	-2,417	-800	+818	+2,435	+4,053
- Low Ocean Freight Market Scenario: compared with Thunder Bay and St. Lawrence	+125	+4,285	+8,445	+12,605	+16,765
- Med. Ocean Freight Market Scenario	-975	+2,085	+5,145	+8,205	+11,265
- High Ocean Freight Market Scenario	-2,675	-1,315	+45	+1,405	+2,765

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EXHIBIT 4.8

OVERALL SYSTEM SAVINGS
RELATIVE TO NO GRAIN MOVEMENT THROUGH CHURCHILL
EXPECTED WITH THE CHURCHILL ROUTE
IN 1986/87 INCLUDING RAILWAY LINE COSTS
(1985 $000's)

	SIZE OF CHURCHILL SHIPPING PROGRAM				
	250,000 tonnes	500,000 tonnes	750,000 tonnes	1,000,000 tonnes	1,250,000 tonnes
Railway System Cost Savings					
- Rate Advantage	230	460	690	920	1,150
- Car Associated Volume Related Costs	-	-	-	-	-
- Line Related Costs	-4,618	-4,518	-4,618	-4,618	-4,618
Port Cost Savings	-4,035	-4,035	-4,035	-4,035	-4,035
Marine System Cost Savings					
- Low Market Scenario: compared with Thunder Bay direct	1,388	2,775	4,163	5,550	6,938
- Low Market Scenario: compared with Thunder Bay and St. Lawrence	3,930	7,860	11,790	15,720	19,650
- Medium Market Scenario	2,830	5,660	8,490	11,320	14,150
- High Market Scenario	1,130	2,260	3,390	4,520	5650
Total - Low Ocean Freight Market Scenario: compared with Thunder Bay direct	-7,035	-5,418	-3,800	-2,183	-565
- Low Ocean Freight Market Scenario: compared with Thunder Bay and St. Lawrence	-4,993	-333	+3,827	+7,987	+12,147
- Med. Ocean Freight Market Scenario	-5,593	-2,533	+527	+3,587	+6,647
- High Ocean Freight Market Scenario	-7,293	-5,933	-4,573	-3,213	-1,853

EXHIBIT 4.9

OVERALL SYSTEM SAVINGS
RELATIVE TO NO GRAIN MOVEMENT THROUGH CHURCHILL
EXPECTED WITH THE CHURCHILL ROUTE
IN 1991/92 NOT INCLUDING RAILWAY LINE COSTS
(1985 $000's)

	SIZE OF CHURCHILL SHIPPING PROGRAM				
	250,000 tonnes	500,000 tonnes	750,000 tonnes	1,000,000 tonnes	1,250,000 tonnes
Railway System Cost Savings					
- Rate Advantage	230	460	690	920	1,150
- Car Associated Volume Related Costs	-765	-1,529	-2,293	-3,058	-3,823
- Line Related Costs	-	-	-	-	-
Port Cost Savings	-4,035	-4,035	-4,035	-4,035	-4,035
Marine System Cost Savings					
- Low Market Scenario: compared with Thunder Bay direct	1,388	2,775	4,163	5,550	6,938
- Low Market Scenario: compared with Thunder Bay and St. Lawrence	3,930	7,860	11,790	15,720	19,650
- Medium Market Scenario	2,830	5,660	8,490	11,320	14,150
- High Market Scenario	1,130	2,260	3,390	4,520	5650
Total - Low Ocean Freight Market Scenario: compared with Thunder Bay direct	-3,182	-2,329	-1,475	-623	+230
- Low Ocean Freight Market Scenario: compared with Thunder Bay and St. Lawrence	-640	+2,756	+6,152	+9,547	+12,942
- Med. Ocean Freight Market Scenario	-1,740	+556	+2,852	+5,147	+7,442
- High Ocean Freight Market Scenario	-3,440	-2,844	-2,248	-1,653	-1,058

EXHIBIT 4.10

OVERALL SYSTEM SAVINGS RELATIVE TO NO GRAIN MOVEMENT THROUGH CHURCHILL EXPECTED WITH THE CHURCHILL ROUTE IN 1991/92 INCLUDING RAILWAY LINE COSTS
(1985 $000's)

	SIZE OF CHURCHILL SHIPPING PROGRAM				
	250,000 tonnes	500,000 tonnes	750,000 tonnes	1,000,000 tonnes	1,250,000 tonnes
Railway System Cost Savings					
- Rate Advantage	230	460	690	920	1,150
- Car Associated Volume Related Costs	-765	-1,529	-2,293	-3,058	-3,823
- Line Related Costs	-4,618	-4,618	-4,618	-4,618	-4,618
Port Cost Savings	-4,035	-4,035	-4,035	-4,035	-4,035
Marine System Cost Savings					
- Low Market Scenario: compared with Thunder Bay direct	1,388	2,775	4,163	5,550	6,938
- Low Market Scenario: compared with Thunder Bay and St. Lawrence	3,930	7,860	11,790	15,720	19,650
- Medium Market Scenario	2,830	5,660	8,490	11,320	14,150
- High Market Scenario	1,130	2,260	3,390	4,520	5650
Total - Low Ocean Freight Market Scenario: compared with Thunder Bay direct	-7,800	-6,947	-6,093	-5,241	-4,388
- Low Ocean Freight Market Scenario: compared with Thunder Bay and St. Lawrence	-5,258	-1,862	+1,534	+4,929	+8,324
- Med. Ocean Freight Market Scenario	-6,358	-4,062	-1,766	+529	+2,824
- High Ocean Freight Market Scenario	-8,058	-7,462	-6,866	-6,271	-5,676

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4.3.1 Analysis of Results

The results presented in Exhibits 4.7 and 4.8 show that potential savings in 1986/87 are substantial provided that railway line related costs are not included and provided there is a reasonable volume of shipment through Churchill. The potential savings are considerably lower if railway line related costs are included and, in fact, only occur for volumes beyond 500,000 tonnes per year for two of the four ocean freight market scenarios. In addition the savings depend to a large extent on conditions in the international shipping market, with negative savings occuring at all throughput levels under the high ocean freight market scenario if rail line related costs are borne by the grain shipper.

Exhibits 4.9 and 4.10 show a similar pattern of potential savings except that the inclusion of the costs of new railway cars increases the volume levels above which savings occur. However the sensitivity of the savings to conditions in the ocean freight market and to the inclusion or exclusion of railway line related costs remains.

A very important question emerges from this analysis: Should the line related railway costs be included in the comparison or not? If they are not used in the comparison (making the implicit assumption that the line will be kept open in any case even if grain is not moved on it), it appears that, both at the present time when there are sufficient boxcars to service Churchill and in the future when additional cars may be required to serve Churchill, potential cost savings associated with the marine system outweigh the increased costs associated with the Port and the expected increase in rail costs. There is therefore a net advantage to using the Port for grain movement under most scenarios studied if the rail line costs are not included.

If the line costs are included in the comparison (that is, if we assume the rail line would be abandoned if there were no Churchill grain program) it appears that when new cars are required to continue operations

to Churchill the use of the Port of Churchill would put the overall Canadian transportation system at a net advantage only at Churchill throughput levels above about 650,000 tonnes per year under one of the low ocean freight market comparisons (Churchill compared to the Thunder Bay and Lower St. Lawrence Port route) and above about 950,000 tonnes per year for the medium ocean freight scenario comparison. There would be a net economic disadvantage to using Churchill for all levels of grain movement studied under the high ocean freight market scenarios and under the low ocean freight market scenario for direct marine shipment (using salties) from Thunder Bay.

This then leads to the following issue that should be addressed by the federal government and other interested parties:

- Would the Churchill line be abandoned if grain were no longer shipped? The Churchill line has other functions beyond the shipment of grain, including the support of the community of Churchill, use of the line for passenger rail service to Hudson Bay Line communities, the use of the line for resupply operations for the eastern Arctic, the strategic importance of the line for sovereignty/defence and for future developments in Northern Manitoba and the Canadian Arctic, etc.

- If the line were to be shut down there would be grain traffic related cost savings to the grain shipper, to the federal government and to CN. On the other hand, there would be cost implications associated with disruption and dislocation to the other users of the line and the communities served by it.

- If the line were retained for reasons other than grain shipment and were used also for grain shipment because of the cost savings its use would achieve, who would pay the necessary basic subsidies?

There is also a second question to be addressed: Which ocean freight rate scenario should be taken as most representative in the comparison? In 1985, rates were at an extremely low level because of declining volumes of bulk materials being shipped and because of overbuild-

ing of new vessels in the early 1980's; industry contacts indicate that the low rates may continue for some time. Two approaches were therefore taken. Firstly, the results for the last five years (1980 - 1985) excluding 1984 (because of the lack of Churchill rate quotations in this year), roughly representing one-half of a typical cycle for the ocean freight market, were averaged. This resulted in an average marine rate advantage for Churchill of $9.41 per tonne after the Seaway toll correction was made. Secondly, the marine rate savings for the four scenarios included in Exhibits 4.7 to 4.10 were averaged, resulting in a Churchill advantage of $9.28 per tonne. The two answers were very similar and the second has been used.

Exhibit 4.11 shows a simplified summary of the information presented in Exhibits 4.7 through 4.10, using the average marine rate advantage. It can be seen that in the short term, when adequate boxcars are available, use of Churchill shows an overall advantage for the case in which railway line related costs are not paid by grain shippers and, for larger volumes above about 850,000 tonnes per year, even when line related costs are paid by grain shippers. By 1991/92, however, Churchill shows an advantage only over about 600,000 tonnes per year when line related costs are not paid by grain shippers and for the volumes shown not at all when line costs are paid by grain shippers.

As stated earlier, this approach makes the implicit assumption that the relative prices that can be realized for grain at the ports will reflect the marine transportation differentials. The three ocean freight rate scenarios indicate that the discount for wheat at Churchill relative to lower St. Lawrence ports should be $4.20, $8.60 and $15.40 per tonne for the low, medium and high ocean rate scenarios respectively. If, for example, the actual selling price realized at Churchill is $2.00 per tonne less than the marine freight rate differential would indicate, then the net savings for Churchill shipment would have to be reduced by $1 million and $2 million in the cases of the 500,000 tonne and 1,000,000 tonne Churchill programs respectively. As can be seen from Exhibit 4.11, this would not

EXHIBIT 4.11

SUMMARY OF OVERALL SYSTEMS SAVINGS RELATIVE TO NO GRAIN MOVEMENT THROUGH CHURCHILL
(1985 $000's)

	1986/87		1991/92	
	500,000 tonnes	1,000,000 tonnes	500,000 tonnes	1,000,000 tonnes
Rail System Volume Related Cost Savings	460	920	-1,069	-2,138
Port Cost Savings	-4,035	-4,035	-4,035	-4,035
Marine System Cost Savings	4,639	9,278	4,639	9,278
Total Cost Advantage if Line Related Costs not paid by Grain Shippers	1,064	6,163	-465	3,105
(Savings per tonne)	(+2.13)	(+6.16)	(-0.93)	(+3.11)
Railway Line Related Costs	-4,618	-4,618	-4,618	-4,618
Total Cost Advantage if Line Related Costs Paid by Grain Shippers	-3,554	1,545	-5,083	-1,513
(Savings per tonne)	(-7.11)	(+1.55)	(-10.17)	(-1.51)

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eliminate the Churchill savings but would reduce them considerably. A higher discount would of course have a greater effect.

4.4 CONCLUSIONS

The above information has led the study team to the following conclusions:

1. There is a marine transportation advantage associated with the use of Churchill compared to Thunder Bay for grain moving to Northwestern Europe and other Atlantic markets.

2. This marine transportation advantage more than compensates for the total costs associated with using the Port and terminal facilities, for higher volumes of grain movement through Churchill.

3. To the extent that the CWB captures the marine freight advantage in the prices charged to buyers, these differences will represent a gain to Canada and to grain growers.

4. There are also railway system costs associated with the Churchill route which are not specifically reflected in the Churchill rates. These costs are associated with the need to have specialized cars for use on the Churchill line (volume related costs) and with the cost of maintaining the line to Churchill (line related costs) which are currently charged to grain transportation.

5. The economic advantage of using the Churchill route for grain movement is reduced if the volume related additional rail costs are taken into account (e.g., to provide special rail equipment to operate on this line), but there would still be an advantage for Churchill grain throughput levels above about 600,000 tonnes per year by 1991/92.

6. When the costs of maintaining the Churchill line in operation are included as a cost of shipping grain through Churchill (and most of these are currently attributed to grain transportation), the Churchill route shows an overall advantage for movements over about 850,000 tonnes under the current railcar supply

situation for average ocean freight rates. When new cars would be required for shipment through Churchill (by 1991/92) use of Churchill at annual throughputs would result in a cost penalty under about 1.25 million tonnes annually over the long run when the full range of ocean freight rate market situations are encountered.

7. It is not at all certain that the rail line from Thompson Junction to Churchill would be abandoned if grain were no longer shipped through Churchill. In this case these line related costs would not be actually saved by eliminating the Churchill grain program and the economic comparison should not include the cost of maintaining the Churchill line in operation. In this case there would be an economic advantage in using Churchill for higher throughput levels, even by 1991/92 when new cars would be required, for annual throughputs above about 600,000 tonnes.

8. It does not seem equitable to charge grain shippers for all of the line related costs of the Churchill route unless this line is maintained specifically for the movement of grain. If in fact the line would not be abandoned if grain were no longer shipped, then consideration should be given to paying some or all of the line related costs out of general government revenues, reflecting the importance of the Hudson Bay route for Canadian sovereignty, defence, Northern development and Arctic resupply as noted earlier.

9. If the Port of Churchill is kept open for grain exports, the greater the volume that is shipped the better off are the grain shipper and the overall grain transportation system. Higher costs occur when Churchill is kept open but only relatively small volumes of grain are shipped through the Port.

5. ALTERNATIVE METHODS OF ARRANGING FOR OCEAN FREIGHT

Grain shipped through Churchill currently is sold almost exclusively by the Canadian Wheat Board (CWB) on a FOB (Free On Board) basis. The purchasers then arrange for the marine shipment of the grain, normally by vessels chartered by the buyer or using state owned vessels or state arranged charters (for movement to Eastern Bloc nations). Under this system, the Canadian Wheat Board offers grain buyers a price at Churchill which includes delivery of the grain into a ship. However, the grain buyer must arrange for the vessel to call at Churchill, must arrange shipment and pay ocean freight charges to the shipowner. It has been suggested that the use of alternative shipping options to FOB, such as CIF (Cost, Insurance and Freight), C&F (Cost & Freight) and C of A (Contract of Affreightment) might be more advantageous to the use of Churchill under certain conditions. In this chapter, we examine each of these alternative shipping options and consider their appropriateness for use in shipping grain from Churchill.

5.1 ALTERNATIVE ARRANGEMENT METHODS

5.1.1 Types of Vessel Charters

There are three basic types of charters used to hire vessels in the for-hire shipping business:

- Voyage Charter: The vessel is chartered for a single, one-way trip, with the shipowner directly paying all the charges for operating the vessel and charging a market rate to the shipper for the voyage;
- Trip Charter: The vessel is hired for a single, one-way trip but the rate charged is expressed as a fixed rate per day. In addition to this fixed rate per day, the shipper pays for the costs of fuel, cargo insurance and navigation tolls incurred during the voyage;
- Time Charter: The vessel is hired for an extended period of time (commonly two months to one year) and is used for multiple voyages during this time period. The shipper is charged a flat rate per day by the shipowner and, in addition, must pay for fuel charges, cargo insurance and navigation tolls incurred during the period of the charter.

Which of these three types of charters is most economic to the shipper depends on the nature of the movements, the existing state of the ocean freight market and other factors. On routes for which there is considerable direct backhaul available, time charters can sometimes be advantageous relative to voyage charters because the vessel can be kept in revenue service most of the time. For routes having low potential for direct backhaul, such as the Churchill route, the voyage charter may be more economic to the shipper. In common practice, a shipper moving grain from Churchill under a voyage charter would pay the shipowner a "ballast bonus" to cover the costs to the shipowner of sailing empty from the North American East Coast to Churchill (this "ballast bonus" is normally incorporated into the voyage charter rate quoted), whereas under a time charter the shipper might have to pay for an entire empty voyage from Europe to Churchill.

The state of the ocean freight market at a given point in time also affects which type of charter is least expensive to the shipper. When the ocean freight market is depressed, as is currently the case in early 1986, a voyage charter is often cheaper than a time charter because market conditions keep voyage charter rates at low fractions of actual vessel costs whereas a time charter may have been negotiated several months beforehand at a higher rate. On the other hand, when the ocean freight market is buoyant, voyage charter rates can increase rapidly at a pace which exceeds any increases in the cost of fuel, insurance and tolls, so that time charters can be significantly less expensive than voyage charters. It is evident that selection of the best type of vessel charter for a particular shipment requires a considerable amount of knowledge and expertise with respect to the world ship chartering business and the characteristics of individual vessels.

5.1.2 Alternative Arrangement Methods

Exhibit 5.1 summarizes the main characteristics and advantages/ disadvantages of the alternative methods of arranging for ocean shipment

EXHIBIT 5.1

CHARACTERISTICS OF ALTERNATIVE OCEAN SHIPPING OPTIONS

	RESPONSIBILITY OF PAYMENT FOR SHIPPING CHARGES				
OPTION	COST TO ON-BOARD POSITION	OCEAN FREIGHT	INSURANCE (CARGO)	OTHER CHARACTERISTICS	ADVANTAGES/DISADVANTAGES
FOB (Free on Board)	Paid by Consignor	Paid by Consignee	Paid by Consignee	Price asked for commodity is FOB port of loading	o desirable when consignee owns ships o low financial risk to consignor compared to CIF and C of A o shipment volumes can be affected by willingness of consignees to use port, not necessarily by relative costs
CIF (Cost, Insurance and Freight)	Paid by Consignor	Paid by Consignor	Paid by Consignor	Price asked for commodity is landed price	o greater potential for hiring vessels on time charter basis for repeat voyages which can reduce shipper rates under certain market conditions o improved scheduling at ports o provides ability to tap into trade patterns if time charters are used o shipment volumes more directly dependent on relative costs of movement o greater financial risk to shipper than F.O.B. if time charters are used
C and F (Cost and Freight)	Paid by Consignor	Paid by Consignor	Paid by Consignee	Price asked for commodity is landed price	Similar to those given above for CIF. There is a slight additional disadvantage in that consignee must arrange to insure the shipment
C of A (Contract of Affreightment)	Paid by Consignor	Paid by Consignor or Consignee, depending on arrangement	Paid by Consignor or Consignee, depending on arrangement	Applies to large volumes moving between a specified set of origins and destinations over an extended time period	o can offer ocean rate savings in a buoyant ocean freight market if fixed time charter rates are used o high risk to shipper because terms are "locked in" over an extended period

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(as distinct from the types of charters outlined above which could each be used under any arrangement method). The arrangement methods are differentiated primarily by which party, the seller (consignor) or buyer (consignee), pays each of the following components of shipment charges:

- o charges for handling and transporting the cargo to on-board ship position;
- o ocean freight charges, and;
- o marine insurance on the cargo.

The C of A option, however, is primarily a type of chartering arrangement between the seller and the shipowner or the buyer and the shipowner to move a specified large volume of a commodity between a set of origins and destinations over an extended time period. Below we assess the suitability of each of these shipping options for shipping grain through Churchill.

FOB

FOB is the predominant shipping option currently used at Churchill. It has two chief advantages. Firstly, this option is desirable when the customer nation operates a state shipping company since, in this case, the customer will want to use its own ships to maximize their utilization and the employment of its sailors. Thus, FOB is likely to be the only acceptable method of shipping to Eastern Bloc Nations and many Third World countries, which have recently constituted a major proportion of the destinations of grain shipped through Churchill. In addition, many of the multi-national grain companies operate their own ships and wish to maximize the use of these vessels.

Secondly, the FOB option carries less risk as compared to the other three options since the Wheat Board does not engage itself in chartering vessels and, hence, does not expose itself to the potential risks of having to pay a shipowner for the services of a vessel even when there may

be no immediate order for grain shipment (if a vessel were hired on a time charter basis) or of paying extremely high freight rates during a period of rate increases (if voyage charters were used). A possible disadvantage of the FOB method relative to increasing the use of Churchill is that under this method, total volumes through the Port are affected by the willingness and ability of buyers to use the Port. If a buyer has difficulty finding a shipowner willing to sail to Churchill or has previously experienced problems in taking delivery at Churchill, the buyer can decide to take delivery of the grain at an alternative port under the FOB shipping option or to accept delivery at Churchill only if a substantial price discount is given at that Port. The "leverage" of the buyer in specifying the port of delivery in Canada or negotiating a price discount for delivery at a port which he considers less desirable is greater in a "buyers' market" for grain (weak demand relative to supply) and less in a "sellers' market" for grain (strong demand relative to supply). This suggests that the ability of the CWB to arrange more FOB deliveries through Churchill will be less in years of weak grain markets (buyers' market) and greater in years of strong grain markets.

CIF

Shipping grain through Churchill CIF offers some possible advantages relative to the principal current method of FOB shipment. Firstly, it could potentially allow the Wheat Board to take greater advantage of the rate savings available by moving through Churchill relative to moving through Thunder Bay because the total movement to the customer nation would be under the control of the Board. The Board would charter ships to move grain to the customer nations and would benefit fully from better netbacks (landed market price minus total transportation and handling charges) that should be obtainable by using Churchill. The problem of the observed reluctance of some grain importers to use Churchill with its attendant requirement to provide price discounts to encourage use of the Port would be lessened because some of these importers might be willing to buy Churchill grain on a delivered price basis at the destination port.

Secondly, if sufficient volumes of CIF movement could be established, the Wheat Board would have the opportunity to hire vessels on a time charter basis for repeated voyages from Churchill. During periods when the ocean freight market is buoyant, the use of time charters in place of voyage charters might offer ocean rate savings, as discussed in subsection 5.1.1. The hiring of the same ships for repeated voyages might also lead to reductions in the Churchill extra insurance premiums paid since the captains of these vessels would accumulate significant experience in navigating the Churchill route, one of the factors now examined by underwriters in their case-by-case setting of the extra premium to Churchill. Any resulting ocean freight rate savings would improve the overall rate savings that might accrue to the Wheat Board from the use of Churchill.

There are, however, some major drawbacks of the CIF option for Churchill. Firstly, as mentioned above, the Eastern Bloc nations and others (such as Brazil and Egypt) with state shipping companies would not accept CIF delivery (unless the Wheat Board were to charter the vessels of these nations). In the period 1980 to 1985, an average of 159,000 tonnes per year was exported through Churchill to other than Eastern Bloc and Third World nations. (See Appendix A for details of the destinations of Churchill exports).

Secondly, the Wheat Board would have to assume considerable risks in chartering vessels. For example, if ships were to be chartered on a time basis during high ocean freight market periods, the shipowner would have to be paid regardless of whether grain shipments through Churchill could be put together. Furthermore, as seen previously, considerable expertise in the ship chartering business is required to select the most economic chartering arrangement for a particular movement; the Board's policy is to retain such expertise through accredited exporters rather than doing it "in-house". At present, there are 21 such accredited exporters of grain from Canada and these companies and government agencies already possess substantial experience in arranging ocean shipment from Churchill to minimize landed costs to buyers. Typically these agents now operate by

buying shiploads of grain from the Board FOB the terminal elevator and delivering the consignment to an overseas customer. Essentially, they are operating as voyage arrangers for the Board although in a formal sense they are purchasing the grain, transporting it and then reselling it. There is little reason to believe that transferring some of the responsibility for vessel chartering to the Wheat Board and attempting to establish a policy of more CIF grain shipments would significantly improve the ocean rates attained for grain shipped through Churchill.

C&F

The C&F method of arranging for ocean shipping is very similar to the CIF option discussed above. The only difference is that in C&F, cargo insurance is directly paid by the buyer rather than by the shipper. This is a relatively minor difference and has little effect on the suitability of the option for shipping through Churchill, and so our assessment of C&F is essentially the same as that provided for CIF.

C of A

As mentioned above, a contract of affreightment (C of A) is a special contract between the seller and shipowner or the buyer and shipowner to move a specified large volume of a commodity between a specified set of origins and destinations over an extended time period (often several years). An example of a contract of affreightment would be an agreement between a shipowner and a mining company for the shipowner to transport, say, 500,000 tonnes of ore from the mine to an overseas smelter every year. The vessels could be provided by the shipowner or could be chartered under any one of the three charter bases outlined in subsection 3.1.1; the shipments could be either FOB or CIF, depending upon whether the agreement is made with the seller or the buyer. In practice a contract of affreightment is normally advantageous when the shipowner can combine two or more large volume movements. For example, coal from Vancouver to Europe might be combined with the movement of phosphate rock from Florida to Vancouver. The shipowner would enter into a C of A with two separate customers.

The C of A method is seldom used in the grain industry, mainly because grain movements tend to be short-term and highly variable. Due to the relatively low volumes of grain moving from Churchill to non-Eastern Bloc ports and the high variability in these volumes and their destinations from year to year, combined with the short Churchill shipping season, it is unlikely that it would be possible for the Wheat Board to negotiate a contract of affreightment with a shipowner for carrying grain out of Churchill. Lack of backhauls toward Churchill will also inhibit the use of this method of shipment. Furthermore, entering into such a contract would be very risky in light of the historically observed variability in the volumes and destinations of Churchill grain.

In summary, the C of A option does not appear to be promising as a method of arranging grain shipments from Churchill.

5.2 CONCLUSIONS

The overall conclusion of our assessment of alternative ocean shipping arrangement options for Churchill grain exports is that an increased use of other shipment methods by the Wheat Board would not significantly improve the level of use of the Port of Churchill. The major buyers of grain from Churchill over the past six years have been Eastern Bloc and Third World Nations which have state shipping fleets and therefore would wish to continue buying grain on a FOB basis. Shipments to Western Europe would be more suitable for possible CIF arrangements, but shipments to these destinations are currently being handled by accredited exporters (multi-national grain companies) having considerable experience in the ship chartering business. There is little reason to believe that the Wheat Board would be able to achieve significantly lower ocean rates if it were to enter the business of chartering vessels on a regular basis. Under certain special circumstances, in particular during a period of a rapidly rising ocean freight market, there might be some opportunity for the Wheat Board to gain limited ocean rate savings by chartering vessels on a time basis for repeated voyages but such arrangements would also carry with it considerable risks to the Board.

Overall, therefore, in our view alternative methods of arranging ocean freight from Churchill such as the CIF arrangement, hold little potential for increasing the use of the Port relative to the existing FOB arrangement. If there is an advantage to Canada of the Board taking a different approach to sales (and these could include the support of a Canadian flag merchant marine or other national purposes), we have not found a specific benefit to associate these with the use of the Port of Churchill; therefore, such evaluations should address the questions on a national basis rather than on a port-specific basis.

6. PORT CAPACITY ANALYSIS

One of the objectives included in the Terms of Reference is to analyze the potential capacity of the Port of Churchill for the movement of grain. In order to do this, a model was developed to simulate Port operations including operations of the elevator and arrivals and waiting/processing operations for vessels and trains.

6.1 PORT OPERATIONS

To understand the way in which the Port and terminal elevator operates, we trace the movement of grain through the system in the following paragraphs.

6.1.1 Train Movement

Grain arrives in trainloads from the Prairies. Normally the trains to Churchill are quite large, 160 boxcars or more. At an average car loading of 55 tonnes per boxcar, a full train will carry about 8,800 tonnes of grain. The train is then broken up into strings of cars corresponding to the lengths of the sidings that are available at the terminal. Cars are then individually unloaded in the unloading house of the elevator. At present all grain moves to Churchill in boxcars and therefore the car unloaders include mechanical devices to tilt the cars in various ways to empty them completely of grain.

6.1.2 Unloading

The unloading house of the elevator has four tracks; four cars can therefore be unloaded at once. As grain is received it is weighed and samples are taken to determine the grade of the grain and the percentage of foreign matter (seeds of other plants, etc.). Once the grain has been unloaded, weighed, and graded, it is then directed to the appropriate bin for storage. Each bin contains only one type and grade of grain.

6.1.3 Cleaning

Churchill normally receives uncleaned grain direct from primary elevators. Therefore, the next stage in the operation is for the elevator to clean the grain. The grain is transferred from the storage bin to the cleaning house, is cleaned and is transferred to another bin for storage as cleaned grain.

6.1.4 Vessel Loading

The elevator staff load vessels after the vessels are moved to the elevator wharf. Grain is moved from the storage bins, is weighed and then is loaded onto the vessel. Again the grain is sampled in order to determine that the correct type and grade of grain is put onto the ship.

6.1.5 Vessel Movements

As purchases of grain are made, arrangements are made for the marine movement of these grains. At the present time, the arrangements for shipment is normally done by the buyer of grain (as described in the previous chapter). The contract between the Wheat Board and the purchaser normally specifies a "window" within which the ship should arrive. Since the vessels involved in this trade are usually carrying many other commodities on other routes at the same time, the actual arrival time of a vessel cannot be specified in any detail, leading to the possibility of bunched arrivals.

When vessels arrive at Churchill they either anchor outside of the harbour or, if space is available at the wharf, they wait for the next ebbing tide to enter the Churchill River. The ebbing tide is necessary so that the ship has adequate steerage in moving to wharf. Before the vessel can be loaded it normally is turned so that the bow is facing down-river. Next it is inspected and passed by the Port Warden and Agriculture Canada. Notification is then given to the elevator that it is

ready to load. The vessels are normally loaded in turn of arrival if the grain for that particular vessel is available within the elevator. When the loading is complete, the vessel normally waits for a rising tide to leave port. The rising tide is desirable both for steerage reasons and to ensure that adequate depth of water is available at the wharf and in the harbour.

For extra large vessels, typically those carrying more than 40,000 tonnes, this operation is complicated because loading can be interrupted because of tidal conditions and the depth of water available at the wharf. Loading cannot start on very large vessels at high tide because the chutes cannot reach the holds when the vessel is very light and high because of the height of the loading gallery. Loading cannot be completed at low tide because, with the limited depth of water available adjacent to the wharf, the vessel may have too much draft for the depth of water available adjacent to the wharf. In this case, loading must be completed on a rising tide and the vessel must depart before the next low tide. These considerations only apply to larger vessels.

6.1.6 Model

A computer model was designed to simulate these conditions. The model is more fully described in Appendix F.

6.2 USE OF THE MODEL

The model was then used to analyze various situations.

6.2.1 Calibration

The first activity was to determine if the model provided a reasonable simulation of actual conditions at the Port of Churchill. The model was run with the same number of ships as actually arrived in 1985 and the actual tonnage moved. It was found that with the initial estimates of

vessel loading rates, the model projected lower than actual times for the vessels in port. The initial loading rate was assumed to be 1,200 tonnes per hour but this does not take account of the need to halt the loading when switching between bins, for changing holds in the vessel, for interruptions due to changes in grades found, for mechanical breakdowns and other factors. Accordingly, the vessel loading rate was modified to 900 tonnes per hour. The period of operation was assumed to be 10 hours a day, six days a week for loading. Unloading and cleaning were assumed to operate 12 hours per day. This was found to give an acceptable simulation of actual 1985 operations with a total vessel time in Port (between vessel arrival outside of the Port and departure) of 149 hours compared to an actual measured 1985 average of 143 hours.

6.2.2 Simulations

A number of additional runs were then performed by making changes in:

- the mode of arrival of the vessels: that is whether they are the actual 1985 arrivals, random arrivals generated by the program or regular arrivals (i.e. every so many hours throughout the season);
- hours of work: in all cases six days a week operation was assumed but the hours of work for the rail car unloading, cleaning and vessel loading operations were varied from 10 hours per day to 24 hours per day;
- throughput through the Port: this was varied from 330,000 tonnes to 1,400,000 tonnes over the three month season;
- the amount of grain storage available: in most of the runs this was set of 112,000 tonnes, being 80% of the nominal capacity of the elevator (140,000 tonnes). This percentage is regarded in the industry as a practical limit;
- train arrivals: the length of trains was varied to match the throughput requirement. At least one train per day arrives. When the throughput increases beyond

one maximum sized train (8,800 tonnes) per day, two trains per day were introduced and train length adjusted accordingly;

- o number of grain types handled: in all but one run it was assumed that three types of grain would be handled. In one run this was reduced to one grain type.

Results are tabulated on Exhibit 6.1.

6.2.3 Discussion of Results

The first line in Exhibit 6.1 represents the results of actual 1985 operations up to the end of October. It does not include the last vessel of the year as this had not occurred when the run was performed. It can be seen that the average hours from vessel arrival to departure is approximately 143. Hours of work in the Port varied with requirements. Twelve hour working was common when there was grain to process.

Calibration Run

Case 2 shows the simulation of 1985 operations, assuming random arrivals of the vessels. Some adjustments had to be made during the calibration process. As discussed above these were to reduce the ship loading rate from a nominal 1,200 per hour to a more realistic 900 tonnes per hour and change the hours of work on vessel loading from twelve hours per day to ten hours per day. The result of the simulation for the simulated average vessel time in Port was 149 hours. On the basis of the matching of the ship times, the simulation was taken as being a reasonable representation of the real situation.

700,000 Tonne Throughput

In Case 3 the throughput was more than doubled to 700,000 tonnes carried in 24 ships. Again random vessel arrivals were used. On this basis the simulated average vessel time in Port was 200 hours. This was

EXHIBIT 6.1

SIMULATION RESULTS

CASE NO.	THROUGHPUT		SHIP ARRIVAL TYPE	HOURS OF OPERATION			ELEVATOR CAPACITY (000's tonnes)	AVERAGE SHIP TIME (hours)
	VESSELS	(000's tonnes)		UNLOADING CARS	CLEANING	VESSEL LOADING		
Actual	12	330	Actual 1985	N/A	N/A	N/A	112	143
2	12	330	Random	12	12	10	112	149
3	24	700	Random	12	12	10	112	200
4	24	700	Random	20	20	10	112	195
5	24	700	Random	20	20	20	112	104
6	36	1,050	Random	20	20	20	112	183
7	36	1,050	Random	24	24	24	112	166
8	48	1,400	Random	20	20	20	112	264
9	48	1,400	Random	24	24	24	112	260
10	48	1,400	Uniform	24	24	24	112	89
11	48	1,400	Random	24	24	24	200	257
12*	48	1,400	Random	20	20	20	112	241
13**	48	1,400	Random	24	24	24	112	208
14***	48	1,400	Random	24	24	24	112	166

* Note shiploading capacity doubled to 1,800 tonnes/hour
** Only one grain type moved through port
*** Grain arranged to arrive six days earlier

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taken to be unacceptable as being more than 8 days. It is interesting to note that this is similar to the situation that occurred in 1976 when approximately 719,000 tonnes were exported and the average vessel time in Port was about 8.7 days. The closeness of this comparison provides a positive indication that the model simulates the Port realistically in terms of vessel delays.

Case 4 is the same as Case 3 except that the car unloading and cleaning hours per day were increased to 20. This should improve the flow of grain into the terminal. The simulated result of this was, however, that the average ship time decreased by only 5 hours, indicating that the limiting factor was the rate of vessel loading.

In Case 5 the loading hours were also increased to 20 hours per day and the simulated average vessel time decreased to 104 hours. Thus a 700,000 annual throughput, within the existing navigation season, appears to be a reasonable proposition with two shift operation of the elevator.

1,050,000 Tonne Throughput

In Case 6 throughput was further increased to 1,050,000 tonnes. In this case the simulated average vessel time was 183 hours or more than 7-1/2 days.

In Case 7 the hours of work were increased to 24 hours per day (but still only 6 days per week). Under this assumption the simulated average ship time decreased to 166 hours indicating that one million tonnes of throughput is within the physical capacity of the elevator and still results in acceptable vessel times.

1,400,000 Tonne Throughput

In Case 8 throughput was increased to approximately 1.4 million tonnes with 48 ships. The simulated vessel time was found to be 264 hours,

again considered to be unacceptable. The remaining runs were changes in Case 8 to try to reduce vessel times.

In Case 9 the hours of work were increased to 24. The simulated average vessel time decreased by only four hours to 260 hours.

In Case 10 the vessel arrival pattern was changed from a random vessel arrival pattern to a completely regular pattern although there were still differences in capacity between vessels. In this case it was also ensured that the types of grain arriving matched the vessel demands. In this case the simulated average vessel time decreased to 89 hours. In this case too it was ensured that the types of grain arriving matched the vessel demands. This indicates that if the movement of vessels can be more tightly controlled, then the average waiting time of vessels can be considerably reduced.

In Case 11 the practical capacity of the elevator was increased from 112,000 to 200,000 tonnes. Compared to Case 10 the vessel time went down by only 3 hours, indicating that storage capacity is not the limiting factor.

In Case 12 the ship loading rate was increased to 1,800 tonnes per hour, but the simulated average vessel time was still 241 hours.

In Case 13 the number of grain types was reduced to one. The simulated average vessel time was 208 hours.

In Case 14 grain train arrivals were scheduled to occur six days earlier than in the other runs. The elvator then could select, from the inventory of grain cars on hand, the right type and grade needed for the next ship. This again simulates the benefit of improved control although the method used implies an inefficiency in the use of rail cars. In this case the simulated average vessel time decreased to 166 hours or almost exactly one week.

The runs carried out for 1,400,000 tonnes per year throughput suggest that a high degree of control of vessel arrival times and grain arrivals would be required to achieve acceptable average vessel times in Port at this throughput level.

6.2.4 Conclusions

Our conclusions from the simulation results are as follows:

- the practical capacity of the elevator, assuming the present configuration, is approximately one million tonnes per year during the current shipping season or about 85,000 tonnes per week over 12 weeks;
- if vessel arrivals could be made more uniform and grain arrivals coordinated with these vessel arrivals, the practical capacity could be much higher, in the order of 1.4 million tonnes per year;
- on the basis of the spread of types of grains analyzed (only three different types of grain were used in the simulation runs) the amount of storage provided seems to be balanced with the handling rates;
- the only practical basis to increase the input to the elevator would be to increase all three handling rates including unloading, cleaning and vessel loading.

Improvements to the control of ship arrivals and better matching of ship requirements to stocks on hand in the elevator were shown to have a major effect on systems efficiency. This ties in with comments that one of the problems associated with greater use of the Port of Churchill for grain exports is that there is limited storage and there is a risk of putting the wrong types of grain into the Port. This problem and problem of matching grain arrivals to ship requirements could be mitigated to some extent by shipping cleaned grain when possible, direct from inland terminals in trainload lots. Such full trainload movements could be much faster. Grain type and grade could be monitored more exactly. This type of operation has not been successful in the past because it was found that, although the grain met export standards when leaving inland terminal, by the time it got

to Churchill and had been unloaded and handled one more time it did not meet these standards and had to be cleaned again. When grain companies are transferring such volumes between the interior and terminal elevators they typically "over clean" the grain to allow for this extra handling. Arrangements could be made to perform a similar operation through Churchill.

6.3 PORT INVESTMENT REQUIREMENTS

Staff at the Port of Churchill have developed a list of capital improvements that they would like to implement over the next few years. Exhibit 6.2 shows these improvements and their estimated cost in 1985 dollars. These improvements can be split into four categories:

- o those required for ongoing operation of any major facility such as replacement of various parts of the machinery. These are normal reinvestments required in the operation of any major capital facility and are included in ongoing depreciation costs;
- o those that are expected to reduce costs such as the purchase of a new tug which is expected to have a smaller crew and therefore reduce operating costs as well as improve operations;
- o those which are required to stay in operation. This particularly refers to the implementation of dust control equipment which is mandated by regulations;
- o those which should improve operations, particularly the construction of a new shipping gallery to enable the loading of larger ships under all tidal conditions.

Except for the loading gallery, none of these improvements will impact on the capacity of the Port.

Modifications of the unloading facilities will be required if articulated hopper cars are to be accepted in the Port. The estimate of $400,000 for modification to the car dumpers is the Port Manager's estimate of the upgrading needed to accept hopper cars (articulated or conventional). There would be an operating cost saving associated with the use of hopper cars which would tend to offset this capital cost.

EXHIBIT 6.2

PROPOSED IMPROVEMENTS - PORT OF CHURCHILL

	COST
Dust Control	$6,032,000
Elevator Safety	154,000
Shipping Monitors (scales)	60,000
Tug Replacement	3,440,000*
Dredging, including dock modifications	6,673,000
Primary Grain Cleaners	474,000
Sewage Treatment	300,000
Manager's Residence	105,000
New Gallery	10,999,000
Open Area Paving - dock, roads	579,000
Modification of Car Dumpers to handle hopper cars	246,000**
Modifications to the Belt Receiving System	2,381,000
Front End Loader	140,000
Trackmobiles	513,000
Elevator Concrete Restoration	395,000
Pellet Mill	1,314,000
Employee Housing	1,981,000
Electrification of Boilers	145,000
Elevator Fire Alarm	245,000
Miscellaneous (over 7 years)	788,000
TOTAL	$36,964,000

* Includes transportation
** Car dumper cost may be about $400,000 today

NOTE: 1985 dollars except for cost item modification of car dumpers that was developed in an earlier engineering study.

SOURCE: Port of Churchill

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7. CONCLUSIONS AND RECOMMENDATIONS

In this chapter the conclusions and recommendations of the study team are presented.

7.1 A POLICY IS REQUIRED

Before specific recommendations can be made as to the most economic use of the Port of Churchill for grain exports, a basic question has to be addressed. Should the Churchill railway line be maintained in operation if grain operations cease? If the answer is yes, then even if grain were not shipped through Churchill the railway line related costs would still have to be paid (e.g., by the Government of Canada); in this case, these costs should be excluded from the economic comparison since they would not result from the movement of grain and should therefore not be paid by grain shippers, as discussed more fully in Chapter 4. If the answer is no, then cessation of grain shipment would be followed by abandonment of the rail line; under this scenario the line related costs would be saved and therefore while the line remains open they should be paid by grain shippers and included in the economic comparison.

The following table, based on 500,000 tonnes per year throughput of grain at the Port of Churchill, gives an estimate of the overall system savings under both scenarios. To obtain this comparison the figures [illegible] Chapter 4 for the low, medium and high ocean freight market scenarios were averaged. The results are as follows:

	Overall System Savings Expected with the Churchill Route at 500,000 tonnes Annual Throughput (1985 $million)	
	1986/87	1991/92
Excluding Railway Line Costs (not paid by grain shipper)	$1.1	-$0.5
Including Railway Line Costs (paid by grain shipper)	-$3.6	-$5.1

Based upon one million tonnes annual throughput the results are as follows:

	Overall System Savings Expected with the Churchill Route at 1,000,000 tonnes Annual Throughput (1985 $million)	
	1986/87	1991/92
Excluding Railway Line Costs (not paid by grain shipper)	$6.2	$3.1
Including Railway Line Costs (paid by grain shipper)	$1.5	-$1.5

These results show that the inclusion or exclusion of the railway line related costs is highly significant in its impact on the economic comparisons. In the short term while there are enough boxcars in service to handle the Churchill movements, there is an economic advantage in maintaining the Port in operation for grain movements if line related costs are excluded or if the volume moved is substantial (above about 850,000 tonnes per year). Over the longer term, use of the Port would achieve cost savings at higher volumes of throughput (over about 600,000 tonnes annually) if the line related costs are excluded.

The various governments and other parties involved should therefore decide whether it is worth covering any losses there may be on the Churchill line relating to grain movement to keep it open for other purposes such as passenger service, Northern development, Arctic and Churchill resupply, national sovereignty, defence, etc. If it is not considered appropriate to subsidize the line related costs, then the decision might be to terminate grain operations at Churchill and close the railway line.

If it is considered that the Churchill rail line and Port should be continued in operation, then the economic comparisons indicate that, under average conditions of the ocean freight markets and grain markets,

use of the Port of Churchill for grain exports at 600,000 tonnes per year throughput would be approximately neutral in terms of overall transportation/handling cost savings by 1991/92. At 1,000,000 tonnes per year throughput the cost savings in the 1991/92 crop year would be about $3.1 million. The economics of export grain transportation and handling, as developed in this analysis, lead then to conclusions numbers 6 and 8 as stated at the end of Chapter 4: use of Churchill at higher grain throughput levels and relief to the grain shipper of some or all of the line related cost burden.

As noted in section 4.3, additional discounts for delivery at Churchill may have to be offered by the Wheat Board for delivery at Churchill. If this actually occurs this will tend to reduce the benefits of maintaining the Port in operation for grain.

7.2 DEVELOPMENT OF THE PORT OF CHURCHILL

The issue relating to maintaining the rail line and port in operation is much broader than the scope of this study, although it is hoped that the economic comparisons presented here will contribute to the development of an informed policy decision.

If the policy decision is to maintain the rail line and Port, then export grain traffic through this outlet should be maintained at substantial levels both because of the savings that would result from its use at such levels and because it is the major existing economic contributor to continuing operation of the line and Port. The recommendations presented below are submitted to assist in on-going development and operation of the Hudson Bay route if this policy option is selected:

1. In terms of grain exports the Port will be economically viable only for higher levels of grain throughput, beyond approximately 600,000 tonnes per year. Maintaining the Port and the railway line and not using it at or above such throughput levels is the worst option in

terms of the economics of handling and transporting export grain.

2. Some investments would be required in the elevator under these conditions. The major one is the implementation of a dust control system which will permit the elevator to meet regulatory standards and improve the safety and environment of the workers, at a capital cost of about $5 million in 1985 dollars. The cost of this improvement has been included in the economic comparisons.

3. The line related costs of the Churchill line, currently about $4.6 million per year, should be paid out of general government subsidies, rather than out of subsidies ear-marked for grain transportation and out of grain freight rates, as a large proportion of these costs are paid now. This would be consistent with the underlying policy decision to maintain the line and the Port in continuing operation for the reasons cited above.

4. To maintain grain service on the Churchill route will require action to ensure a supply of cars. In the short term this may be done by an interchange agreement between CP and CN to permit CP cars to be used for this movement. This may also reduce railway operating costs somewhat. Over the longer term three options are possible: rehabilitation of additional boxcars, construction of new cars specially designed for the line such as the articulated hopper car now under development, or refurbishment of the line so that it can handle conventional hopper cars. An early decision on the best method is required so that design and methods of financing can be developed. The estimated costs of the articulated car option were included in the economic comparisons.

5. Consultation should take place among the Canadian Wheat Board, the Governments of Canada and Manitoba and other interested parties in order to reach a consensus on how to achieve the benefits associated with the use of the Port of Churchill for grain exports.

6. Overseas buyers and shipowners should be made more familiar with operations through the Port of Churchill. It was found that some had an "irrational" fear of taking delivery of grain through the Port. The Governments of Canada and Manitoba have already made a start in this by familiarizing the international insurance business with Port operations and improvements made to the operation of the sea routes to and from Churchill.

7. Better communications and information services should also be established to ensure that captains sailing to and from Churchill, particularly early and late in the season are fully informed about ice conditions and that the Canadian Coast Guard is informed of vessel arrivals and departures so that ice breaking escort services can be provided on a timely basis. This is discussed more fully in the Study A report.

If the decision is taken that the line should be closed over the long term then the study team has the following conclusions and recommendations:

1. Today, with existing car supply, the Port should be used for Churchill volumes of over about 800,000 tonnes per year. If this volume can be achieved then the Port and railway line should be kept open until attrition in the boxcar fleet no longer permits this level of throughput.

2. The elevator and the line should be maintained in safe operation for this period with a minimum of new capital investment.

7.3 SUMMARY

The economic analyses presented in this report indicate that use of the Port of Churchill and the rail line serving it as a route for export grain is likely to be economically viable into the 1990's under medium or low ocean freight market conditions, and under medium or high world grain market conditions provided that the grain throughput levels are in the order of 600,000 tonnes per year or higher through the Port. This conclusion is based on the assumption that the line related costs of the rail line would be government-subsidized (in recognition of the Port's broader role and strategic significance) rather than being borne by the grain shipper. The conclusion is also based upon the assumption that the Canadian Wheat Board can sell grain at Churchill for a price which reflects the actual marine transportation cost differential for onward delivery of the grain. While CWB commercial secrecy precludes verifying this assumption there is reason to believe that it is largely true in years of

normal and strong grain markets and that discounts in years of weak grain sales would still be less than the entire marine freight rate differential.

The policy question to be addressed is whether the potential savings in grain transportation/handling costs and the other strategic reasons for continuing the Port and rail line in operation are sufficient to decide in favour of their continuing operation, recognizing the subsidy requirement for rail line related costs. If not, the economics of grain export movements suggest that the governments and other interested parties should address the broader policy implications of ceasing the movement of grain through Churchill and (if the line related costs are to be saved) abandoning the rail line. Among these policy implications (which are beyond the scope of analysis of this study), in addition to the immediate strategic and Northern development factors mentioned earlier, is the consideration that the rail line and the Port do exist, the marginal cost of maintaining them in operation for grain exports is quite modest (about $3-4 million per year in 1985 dollars by 1991/92 at Churchill grain throughput levels of about 1,000,000 tonnes per year), they may be badly needed during the coming decades for strategic reasons and possibly for grain exports, and their future replacement costs if abandoned now would be large.

If the policy decision is to maintain the rail line and Port, then export grain traffic through this outlet should be maintained at substantial levels both because it is estimated to be economically viable in comparison with alternative ports at such levels and because it is the major existing economic contributor to continuing operation of the line and Port. The recommendations presented above are submitted to assist in on-going development and operation of the Hudson Bay route if this policy option is selected.

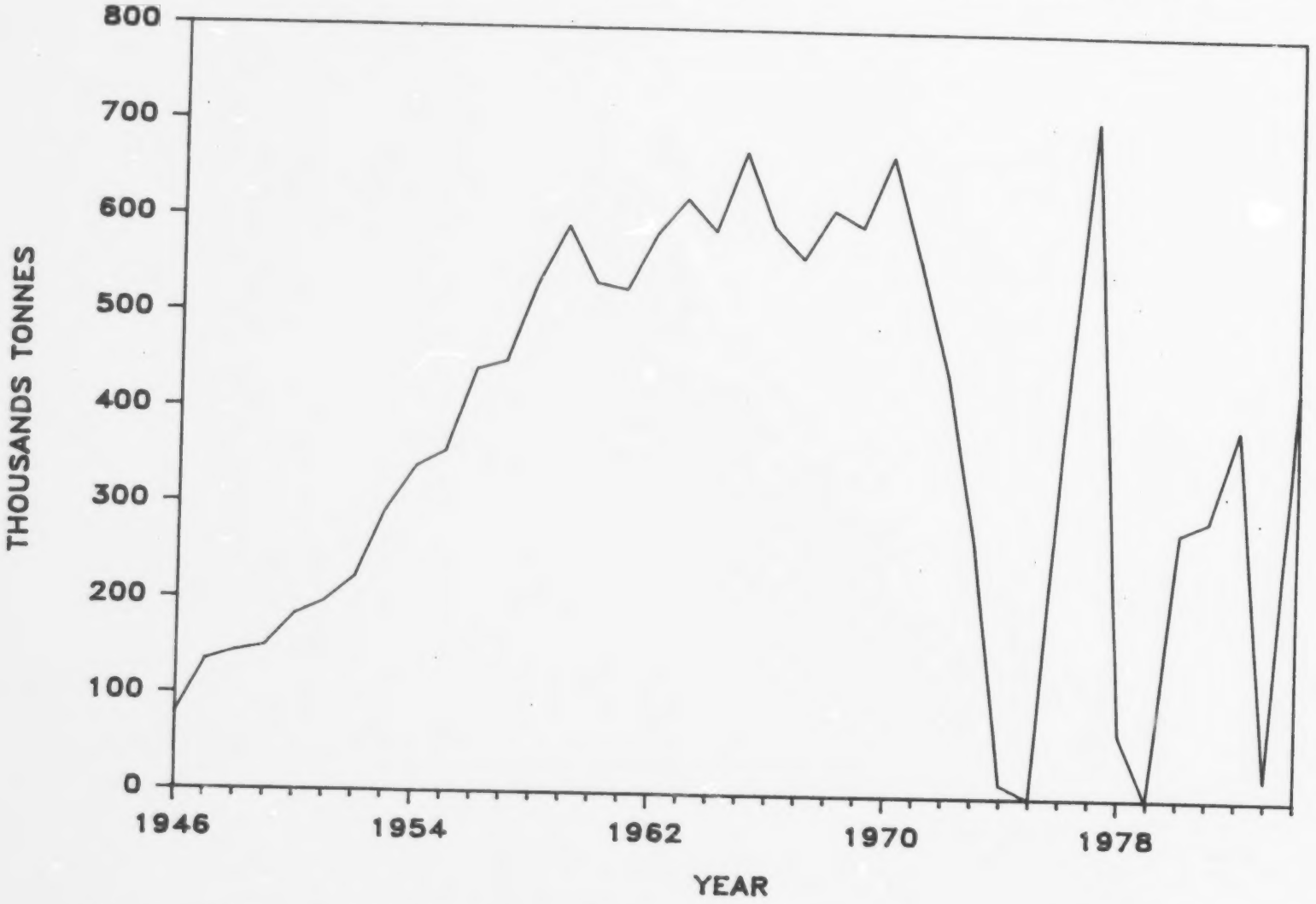
In the meantime, it is hoped that the economic comparisons presented in this report will assist the Government of Canada, the Government of Manitoba and other interested parties in reaching the most appropriate policy decision in the long term interests of the country and its various regions.

APPENDIX A

HISTORICAL CHURCHILL WHEAT AND BARLEY SHIPMENTS AND DESTINATIONS OF GRAIN EXPORTS FROM CHURCHILL

EXHIBIT A.1

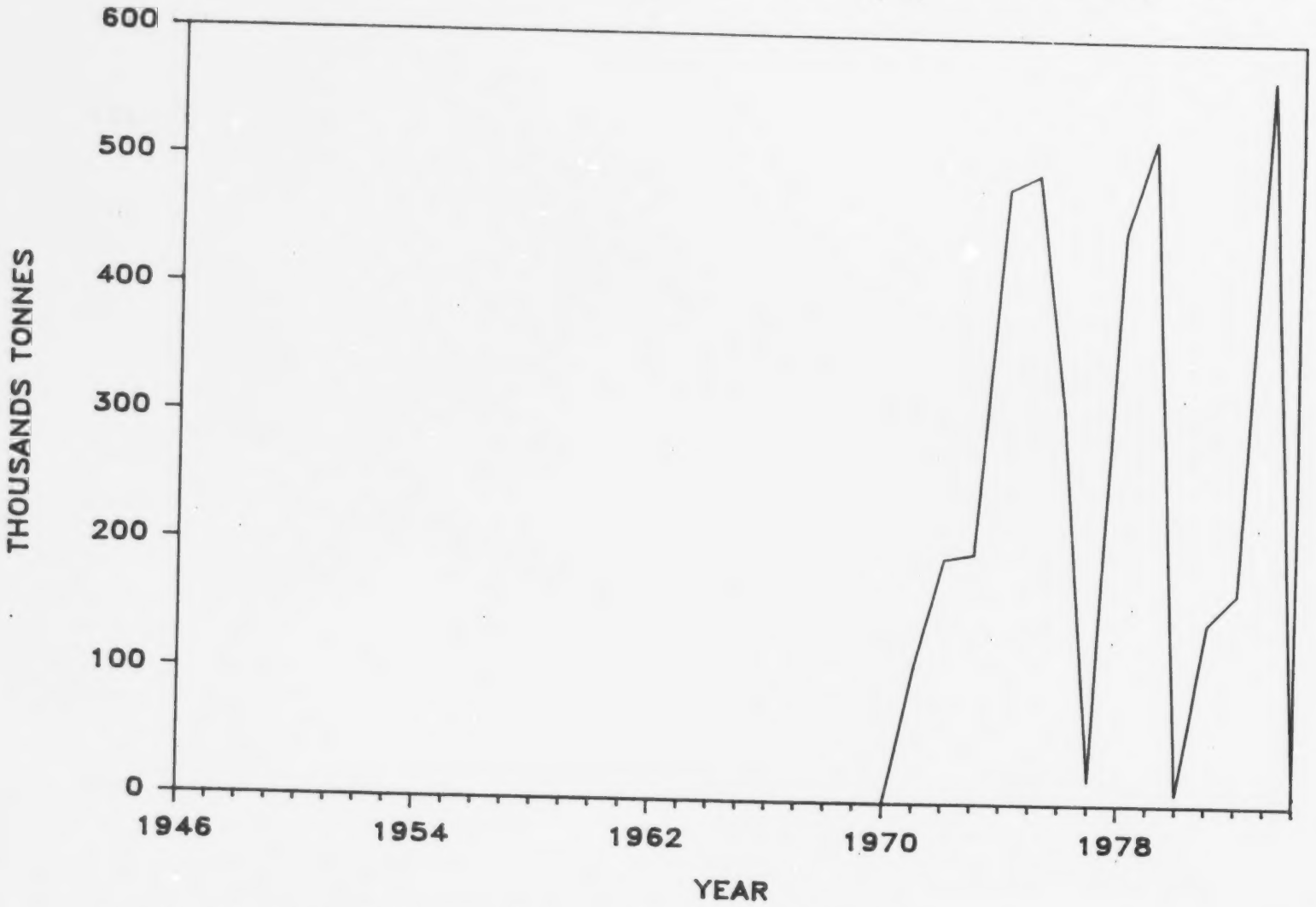
CHURCHILL WHEAT SHIPMENTS



Source: National Harbours Board, Annual Traffic Reports, 1946-1980; and Port of Churchill Records

EXHIBIT A.2

CHURCHILL BARLEY SHIPMENTS



Source: National Harbours Board, Annual Traffic Reports, 1946-1980; and Port of Churchill Records

EXHIBIT A.3

EXPORTS OF GRAIN BY DESTINATION FROM PORT OF CHURCHILL
1960/61 TO 1973/74

DESTINATION	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	TOTAL	AVERAGE	AVERAGE PERCENT (%)
EUROPE																	
WESTERN EUROPE																	
UNITED KINGDOM	463.4	370.2	406.3	379.5	356.8	398.7	318.6	295.3	370.5	346.0	360.4	193.4	203.4	0.0	4462.5	318.8	54.1
BELGIUM-LUXEMBOURG	43.9	27.3	43.1	71.1	89.2	97.5	101.5	96.9	28.6	81.6	86.2	37.4	123.2	16.3	943.8	67.4	11.4
IRELAND	0.5	0.0	0.0	9.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.4	0.7	0.1
NORWAY	14.7	42.3	42.9	45.3	43.6	54.1	22.7	32.5	0.0	16.6	58.4	21.2	0.0	0.0	394.3	28.2	4.8
SWITZERLAND	26.2	26.7	7.3	5.8	0.0	11.8	2.6	4.5	26.0	24.4	14.5	16.1	2.4	0.0	168.3	12.0	2.0
FINLAND	0.0	8.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.5	0.6	0.1
GERMANY,WEST	0.0	48.6	38.1	58.0	31.3	62.8	26.0	31.2	51.8	40.6	46.4	52.8	7.3	0.0	497.1	35.5	6.0
FRANCE	0.0	0.0	0.0	14.8	0.0	18.9	4.6	16.9	11.9	5.0	6.6	5.3	0.0	0.0	84.0	6.0	1.0
NETHERLAND	0.0	0.0	42.6	5.6	15.7	24.3	22.9	2.5	14.0	82.0	0.6	16.4	55.4	0.0	282.0	20.1	3.4
AUSTRIA	0.0	0.0	0.0	0.0	12.3	14.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	26.6	1.9	0.3
SWEDEN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	0.0	0.9	0.0	0.0	2.4	0.2	0.0
DENMARK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.6	0.0	0.0
ITALY	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	18.4	0.0	24.6	41.4	207.5	53.4	345.3	24.7	4.2
MALTA	0.0	0.0	12.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.2	0.9	0.1
TOTAL	548.7	523.8	592.5	590.0	548.9	682.4	500.9	479.8	521.2	597.7	598.3	384.9	599.2	69.7	7238.0	517.0	87.8
EASTERN EUROPE																	
CZECHOSLOVAKIA	0.0	0.0	0.0	0.0	22.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	22.0	1.6	0.3
POLAND	0.0	0.0	0.0	0.0	17.9	0.0	36.1	36.6	35.3	0.0	0.0	0.0	0.0	13.4	139.3	10.0	1.7
U.S.S.R.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	70.0	11.5	0.0	0.0	0.0	0.0	266.9	348.4	24.9	4.2
GERMANY,EAST	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BULGARIA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ALBANIA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	36.5	0.0	36.5	2.6	0.4
TOTAL	0.0	0.0	0.0	0.0	39.9	0.0	36.1	106.6	46.8	0.0	0.0	0.0	36.5	280.3	546.2	39.0	6.6
WESTERN HEMISPHERE																	
CUBA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	46.6	0.0	38.6	0.0	0.0	24.1	109.3	7.8	1.3
DOMINICAN REPUBLIC	0.0	0.0	0.0	0.0	11.5	0.0	35.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	46.9	3.4	0.6
TOTAL	0.0	0.0	0.0	0.0	11.5	0.0	35.4	0.0	46.6	0.0	38.6	0.0	0.0	24.1	156.2	11.2	1.9
MEDITERRANEAN & ASIA																	
TURKEY	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	18.3	18.3	1.3	0.2
IRAQ	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	22.7	0.0	0.0	22.7	1.6	0.3
BANGLABESH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	69.7	69.7	5.0	0.8
INDIA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	194.0	0.0	0.0	194.0	13.9	2.4
TOTAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	216.7	0.0	88.0	304.7	21.8	3.7
TOTAL EXPORTS	548.7	523.8	592.5	590.0	600.3	682.4	572.4	586.4	614.6	597.7	636.9	601.6	635.7	462.1	8245.1	588.9	100.0

EXHIBIT A.4

EXPORTS OF GRAIN BY DESTINATION FROM PORT OF CHURCHILL

1974/75 TO 1985/86

DESTINATION	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	TOTAL	AVERAGE	AVERAGE PERCENT (%)
EUROPE WESTERN E															
UNITED KINGDOM	15.0	0.0	24.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	39.5	3.3	0.644
BELGIUM-LUXEMBOURG	0.0	47.4	0.0	0.0	0.0	0.0	0.0	25.0	168.0	294.0	0.0	0.0	534.4	44.5	8.716
NORWAY	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	53.1	53.1	4.4	0.866
GERMANY,WEST	0.0	60.2	62.5	0.0	0.0	30.9	0.0	0.0	0.0	0.0	0.0	59.5	213.1	17.8	3.476
FRANCE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	21.0	0.0	25.0	46.0	3.8	0.750
ITALY	222.4	44.9	219.1	0.0	29.0	0.0	24.9	0.0	0.0	22.0	0.0	0.0	562.3	46.9	9.171
SPAIN	14.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.0	1.2	0.228
TOTAL	251.4	152.5	306.1	0.0	29.0	30.9	24.9	25.0	168.0	337.0	0.0	137.6	1462.4	121.9	23.852
EASTERN EUROPE															
POLAND	144.9	256.0	115.0	89.0	324.7	197.4	195.0	294.0	389.0	83.0	0.0	0.0	2088.0	174.0	34.056
U.S.S.R.	0.0	59.3	52.3	0.0	0.0	267.3	69.6	93.0	0.0	44.0	167.0	126.4	878.9	73.2	14.335
GERMANY,EAST	0.0	0.0	193.8	0.0	0.0	0.0	0.0	0.0	0.0	63.0	0.0	0.0	256.8	21.4	4.188
BULGARIA	57.8	0.0	0.0	0.0	30.6	0.0	0.0	0.0	0.0	0.0	0.0	23.1	111.5	9.3	1.819
ROMANIA	0	0	0	0	0	0	0	0	0	66.0	0.0	0.0	66.0	5.5	1.076
TOTAL	202.7	315.3	361.1	89.0	355.3	464.7	264.6	387.0	389.0	256.0	167.0	149.5	3401.2	283.4	55.475
WESTERN HEMISPHERE															
MEXICO	0.0	0.0	0.0	25.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	25.6	2.1	0.418
BRAZIL	0.0	0.0	0.0	70.2	0.0	0.0	0.0	0.0	0.0	0.0	205.0	0.0	275.2	22.9	4.489
TOTAL	0.0	0.0	0.0	95.8	0.0	0.0	0.0	0.0	0.0	0.0	205.0	0.0	300.8	25.1	4.906
MEDITERRANEAN & ASIA															
IRAQ	0.0	0.0	0.0	98.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	98.9	8.2	1.613
SYRIA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	64.0	0.0	64.0	5.3	1.044
SAUDI ARABIA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	26.0	0.0	0.0	0.0	31.5	57.5	4.8	0.938
CYPRUS	0.0	0.0	0.0	0.0	40.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	40.6	3.4	0.662
IRAN	29.4	26.5	27.5	0.0	31.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	114.4	9.5	1.866
EGYPT	0.0	0.0	0.0	382.7	63.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	446.3	37.2	7.279
LEBANON	14.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.5	1.2	0.236
MORROCCO	0.0	0.0	0.0	62.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	62.8	5.2	1.024
ALGERIA	0.0	0.0	0.0	0.0	0.0	27.2	0.0	0.0	0.0	0.0	0.0	0.0	27.2	2.3	0.444
NIGERIA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	40.5	40.5	3.4	0.661
TOTAL	43.9	26.5	27.5	544.4	135.2	27.2	0.0	26.0	0.0	0.0	64.0	72.0	966.7	80.6	15.767
TOTAL EXPORTS	498.0	494.3	694.7	729.2	519.5	522.8	289.5	438.0	557.0	593.0	436.0	359.1	6131.1	510.9	100.000

APPENDIX B

BEHAVIOR OF W.G.T.A. GRAIN RATES - 1983/84 TO 1985/86

APPENDIX B

BEHAVIOUR OF W.G.T.A. GRAIN RATES - 1983/84 TO 1985/86

The operation of the mechanisms of the Western Grain Transportation Act on railway rates grain has introduced a few anomalies, particularly in terms of the proportions of the total rate shared by the producer and Federal Government. On the attached Exhibit B-1 are shown some examples of the producer share and the government subsidy for specific movements to Thunder Bay and to Churchill from the central Prairies.

The producer share of the total increased as expected from 1983/84 to 1984/85 but decreased considerably in 1985/86. The actual proportion of the total rate paid by the producer or shipper has been as follows:

1983/84	23.3%
1984/85	30.4%
1985/86	21.4%

The total rate received by the railways has increased over the years. Expressed as a multiplier of the original Crow Rate and as a percentage increase from year to year the results are as follows:

	CROW MULTIPLIER	INCREASE OVER PREVIOUS YEAR
1983/84	5.06	+406.00%*
1984/85	5.22	+ 3.16%
1985/86	5.78	+ 10.73%

* Increase over Crow Rate

The shipper portion of the total has increased much less. Looking at the same three origin points, the average rate paid by the shipper has varied as follows:

	TO CHURCHILL ($/tonne)	TO THUNDER BAY ($/tonne)	INCREASE OVER PREVIOUS YEAR
1983/84	5.09	5.18	+17.91%*
1984/85	6.85	6.98	+34.6%
1985/86	5.34	5.44	-22.1%

* Increase over Crow Rate

Thus the rate paid by the shipper in 1985/86 is almost back to the 1983/84 value.

With respect to the comparisons between rates to Churchill and to Thunder Bay and Vancouver, it should be pointed out that, for Board grains, the shipper pays the rate to Thunder Bay or Vancouver (depending upon the station) rather than to Churchill by deduction from his original payment from the CWB. The CWB keeps or pays any difference in the rate paid by the producer and the amount actually paid to the railway, incorporating this into the overall profit pool.

EXHIBIT B-1

EXAMPLE GRAIN RATE
($/tonne)

	1983/84		1984/85		1985/86	
	A	B	A	B	A	B
From Hudson Bay, Sask.						
- to Churchill	4.49	14.79	6.05	13.84	4.71	17.31
- to Thunder Bay	5.34	17.58	7.19	16.46	5.60	20.58
From Saskatoon, Sask.						
- to Churchill	5.44	17.89	7.31	16.75	5.70	20.95
- to Thunder Bay	5.62	18.52	7.57	17.33	5.90	21.63
From Dauphin, Man.						
- to Churchill	5.34	17.58	7.19	16.46	5.60	20.58
- to Thunder Bay	4.59	15.09	6.17	14.14	4.81	17.67

A - Shipper Share
B - Government Share

APPENDIX C

ANALYSIS OF COST IMPACTS OF SHIFTING GRAIN BETWEEN THUNDER BAY AND CHURCHILL

ANALYSIS OF COST IMPACTS OF SHIFTING GRAIN BETWEEN THUNDER BAY AND CHURCHILL

As explained in the main text, the cost structure of operation of Thunder Bay can be expressed as follows:

$$F(T) + M(T) \times V(T)$$

where F(T) are the fixed costs at Thunder Bay in total dollars
M(T) are the marginal costs at Thunder Bay in $ per tonne carried
V(T) is the flow through Thunder Bay in tonnes.

Similarly the costs at Churchill can be represented by:

$$F(C) + M(C) \times V(C)$$

where F(C) are the fixed costs at Churchill in total dollars
M(C) are the marginal costs at Churchill in $ per tonne carried
V(C) is the flow through Churchill in tonnes.

Total system costs for grain movement through both ports are therefore:

$$F(T) + F(C) + M(T) \times V(T) + M(C) \times V(C)$$

Therefore if an additional G tonnes of grain were moved through Churchill instead of Thunder Bay, then the overall cost increase would be:

$$G \times M(C) - G \times M(T)$$

But as has been shown in the text, the marginal costs at Churchill and Thunder Bay are essentially identical and therefore there would be no significant changes in overall costs with such shifts in volume.

If no grain were to be moved through Churchill, however, then some part of the fixed costs at Churchill F(C), could be saved. Thus, this "saveable" portion of fixed costs represents an additional charge of using the Port of Churchill.

APPENDIX D

DETAILS OF OCEAN BULK VESSEL COST MODEL AND RESULTS

APPENDIX D

DETAILS OF OCEAN BULK VESSEL COST MODEL AND RESULTS

INTRODUCTION

This Appendix provides details of the structure and assumed parameter values of the ocean bulk vessel cost model developed to examine and compare the cost of owning and operating an ocean vessel to carry export grain from each of Churchill, Thunder Bay, Montreal and Baie Comeau to the representative Northwestern European port area of Antwerp/Rotterdam. It was also suggested that Quebec City should be examined but it was decided that, since results for Quebec should be between those for Montreal and Baie Comeau, examining costs for Quebec City would not add to the knowledge gained in this analysis. This Appendix also provides additional details of the model results summarized in Chapter 3 in the body of this report, and in particular, gives breakdowns of the total cost by component for each of the alternative routes.

As stated in Chapter 3, the ocean bulk vessel cost model has been developed using information on vessel costs and operating characteristics derived from two principal sources: shipowners and the 1984 study Bulk Carrier Costs and Profitability to 1995 published by C.S.R. Consultants. The C.S.R. Study, which presents average vessel costs by component based on the analysis of a large number of surveys of actual individual vessel costs, shows that the magnitudes of the various costs associated with owning and operating a vessel differ significantly between different vessels according to such factors as vessel size, type, age, flag (country of registry), method of financing the vessel building price, and crew nationality. In comparing ocean freight costs for alternative routes, therefore, it is essential that the cost and operating characteristics used correspond to a vessel type that is quite narrowly specified. In running our cost model, we have assumed the use of 25,000 and 40,000 deadweight tonnes (DWT) non ice-strengthened bulkers built in the early 1980s and sailing under Western European flags. The corresponding costs for other

types of vessels (such as ice-strengthened vessels and tankers), vessels sailing under other flags and with crews of other nationalities would be different than those estimated here. In general, the estimated costs given here should be taken as being representative of the higher cost tramp shipping operations.

MODEL STRUCTURE

The ocean bulk vessel cost model has the following structure:

TOTAL VESSEL COST = [(OC + CAP) x (DN + DP) + CMP x PM x DP + CMN x PM x DN + CFN x PF x DN + PCL + PCU + P + S + IC] x BHF

Where:
- OC = Operating Cost of Vessel ($/day)
- CAP = Capital Charge for Vessel ($/day)
- DN = Days in Navigation
- DP = Days in Port
- CMP = Consumption Rate of Marine Diesel Fuel in Port (tonnes/day)
- PM = Price of Marine Diesel Fuel ($/tonne)
- CMN = Consumption Rate of Marine Diesel Fuel in Navigation (tonnes/day)
- CFN = Consumption Rate of Marine Fuel Oil in Navigation (tonnes/day)
- PF = Price of Marine Fuel Oil ($/tonne)
- PCL = Port Charges at Port of Loading
- PCU = Port Charges at Port of Unloading
- P = Pilotage Fees
- S = Canal and other Tolls (e.g. - St. Lawrence Seaway)
- IC = Extra Insurance Premium for Churchill
- BHF = Backhaul Factor

This formula is used to calculate the total cost of owning and operating a vessel for one return voyage, with or without backhaul cargo. Brief descriptions of each of the cost elements contained in the above formula are given below.

Operating Cost

This cost category comprises the expenses incurred by the shipowner in manning, repairing, maintaining, managing and insuring the vessel. Operating cost is incurred whenever the vessel is in service and under normal circumstances is basically unaffected by whether the vessel is sailing or is in port. It should be noted that in our cost model, the insurance component included within the operating cost term represents a vessel's typical basic premium for hull and machinery (H & M) and protection and indemnity (P & I) insurance coverage. The additional insurance premium that has historically been assessed by Lloyds of London for voyages to Churchill is treated as a separate term in the model.

Capital Charge

The capital charge for a vessel is a uniform charge per unit time applied over its operating life so that the original capital cost (purchase price) of the vessel can be recovered in full. The appropriate capital charge for a given vessel depends on several financial and tax factors including the relative proportions of debt and equity used to finance a vessel purchase, the interest rate paid on loans and the depreciation allowances provided in the country of registry. The capital charge is incurred by the shipowner regardless of whether or not the ship is in service.

Fuel Costs

This category represents the expenses incurred during a voyage for bunker fuel. The typical newly built ocean bulker uses two types of fuel. In port, the vessel consumes marine diesel, a light fuel, to power its electric generator. In navigation, in addition to marine diesel to run the generator, the vessel burns a heavy fuel known as marine fuel oil to power its main engines. The grade of marine fuel oil used differs from one

vessel to another. Fuel cost is incurred by the shipowner only when the vessel is in service and varies with the speed of navigation and, in ice-infested waters, with the extent of coverage of the ice.

Within the cost formula, the fuel cost is given by the following terms: Fuel cost ($) = CMP x PM x DP + CMN x PM x DN + CFN x PF x DN.

Port Charges

This category includes all charges incurred during a voyage when the ship is in port to load or discharge cargo and includes harbour dues (charges payable on entering a harbour), stevedoring, elevator overtime, berthage charges, harbour pilotage, port agency fees and tug fees. Port charges vary by port and by the size of the vessel. In our cost model, we have used average total port charges at the various ports considered rather than examining each of the components individually. Total port charges for a voyage are given in the formula as: Port Charges ($) = PCL + PCU.

St. Lawrence Seaway Tolls and Pilotage Fees

Ocean vessels transiting the Great Lakes and St. Lawrence Seaway and the St. Lawrence River between Montreal and Escoumins, Quebec, incur Seaway tolls and pilotage charges. The Seaway tolls consist of three components: GRT tolls based on the gross registered tonnage of the vessel, cargo tolls based on the tonnage and type of cargo carried by the vessel, and lockage fees assessed for transiting the eight locks on the Welland Canal. The cargo tolls are normally paid by the shipper while GRT tolls and lockage fees are costs incurred by the shipowner.

Pilotage fees are fees charged for the services of a pilot in designated areas of the St. Lawrence Seaway and in the section of the St. Lawrence River between Montreal and Escoumins. These fees vary with the size of the vessel and the amount of time the pilot spends on board. In our cost model, we have used typical total pilotage fees for the St.

Lawrence Seaway and St. Lawrence River in estimating costs for export grain voyages from Thunder Bay and Montreal.

PARAMETER VALUES AND MODEL RESULTS

The values entered for the parameters of the ocean vessel cost model defined previously are presented in Exhibits D.1 and D.2. Exhibit D.1 lists the values used to represent 1985 vessel operating and capital costs, operating characteristics and fuel prices while Exhibit D.2 lists the values used for 1985 port charges, Seaway tolls and pilotage fees as well as port and sailing times and the extra Churchill insurance premiums. As stated earlier, the parameter values used in our analysis are representative of non ice-strengthened bulkers built in the early 1980s and sailing under Northwest European flags. The data was obtained primarily from interviews with shipowner companies and from the C.S.R. Study on bulk carrier costs, supplemented by published information on current Seaway tolls and pilotage fees.

The extra insurance premium incurred for a voyage to Churchill has been estimated as $40,000 for the 25,000 DWT bulker and $50,000 for the 40,000 DWT bulker. These values have been estimated by applying the additional premium for non ice-strengthened vessels set by the Churchill clause (used as a guide by London underwriters), namely 30% of the basic annual hull and machinery (H & M) premium, to average H & M premiums given in the C.S.R. Study. As noted in Chapter 3, the method of setting the extra Churchill premium is currently under review by the London underwriters and in the meantime the extra premium is being determined on a ship-by-ship basis, taking into account the time of the season, vessel type, the experience of the ship's captain in ice navigation, and other factors. Therefore, in the future, the extra insurance premiums for voyages to Churchill could show a higher degree of variability than is currently the case and may be significantly different than the representative current values used in our model. For example, extra premiums for vessels which have previously sailed to Churchill and which

EXHIBIT D.1

1985 OCEAN VESSEL OPERATING AND CAPITAL COSTS, OPERATING CHARACTERISTICS AND FUEL PRICES

MODEL PARAMETER	VESSEL TYPE	
	25,000 D.W.T. NON ICE-STRENGTHENED BULKER	40,000 D.W.T. NON ICE-STRENGTHENED BULKER
OPERATING AND CAPITAL COSTS		
Operating Cost ($/day)	4,900	6,400
Capital Charge ($/day)	4,670	6,900
FUEL CONSUMPTION RATES		
Marine Diesel Fuel in Port (Tonnes/day)	2	2
Marine Diesel Fuel in Navigation (Tonnes/day)	2	2
Marine Fuel Oil in Navigation (Tonnes/day)	25	32

FUEL PRICES: Marine Diesel = $316/Tonne
Marine Fuel Oil = $237/Tonne

SOURCES: CSR Consultants, Bulk Carrier Costs and Profitability to 1995, 1984; and interviews with shipowners.

EXHIBIT D.2

1985 PORT CHARGES, SEAWAY TOLLS, PILOTAGE FEES, PORT AND SAILING TIMES, AND EXTRA CHURCHILL INSURANCE PREMIUMS

MODEL PARAMETER	VESSEL TYPE	
	25,000 D.W.T. NON ICE-STRENGTHENED BULKER	40,000 D.W.T. NON ICE-STRENGTHENED BULKER
PORT CHARGES (including harbour dues, stevedoring, elevator overtime, port agency, berthage charges, and tug fees)		
Churchill	$20,000	$25,000
Thunder Bay	15,000*	-
Montreal	10,000	15,000
Baie Comeau	10,000	15,000
Antwerp/Rotterdam	15,000	20,000
SEAWAY TOLLS		
For round trip voyage from Thunder Bay (portion paid by shipowner)	$10,000	-
PILOTAGE FEES		
For round trip from Montreal	$10,000	$13,500
For round trip from Thunder Bay	40,000	-
PORT TIMES		
Loading at Churchill	5.2 days	6 days
Thunder Bay	5.5 days**	-
Montreal	3 days	3.5 days
Baie Comeau	2 days	2.5 days
Unloading at Antwerp/Rotterdam	2 days	2.5 days
EXTRA CHURCHILL INSURANCE PREMIUM	$40,000	$50,000

ONE-WAY SAILING TIMES

Churchill to Antwerp/Rotterdam = 11 days
Thunder Bay to Antwerp/Rotterdam = 15 days
Montreal to Antwerp/Rotterdam = 10 days
Baie Comeau to Antwerp/Rotterdam = 9 days

* Represents charges at Thunder Bay and further charges incurred at a St. Lawrence port for topping-off.

** Represents time spent in loading at Thunder Bay plus time spent in topping off at a St. Lawrence port.

SOURCES: Interviews with Shipowners; CSR Consultants, Bulk Carrier Costs and Profitability to 1995, 1984.

have captains experienced in ice navigation are expected to be lower than the historical values.

Using the parameter values listed in Exhibits D.1 and D.2, we have run the ocean bulk vessel cost model to estimate total and component costs for return export grain voyages from each of Churchill, Thunder Bay, Montreal and Baie Comeau to Antwerp/Rotterdam. For Thunder Bay, we have assumed that the 25,000 DWT bulker loads approximately 18,000 tonnes of grain in Thunder Bay and then completes its cargo with a 7,000 tonne top-off at a lower St. Lawrence port, which is typical of the current operating practice for "salties" taking grain from Great Lakes ports. The ocean freight cost for the 18,000 tonnes of grain loaded in Thunder Bay have been calculated using:

$$\text{Ocean Freight Cost (\$/tonne)} = \frac{\text{Return Cost for Thunder Bay to Montreal}}{18{,}000} + \frac{\text{Return Cost for Montreal to Antwerp/Rotterdam}}{25{,}000}$$

This formula assumes that the grain used to top off at a lower St. Lawrence port in effect cross-subdizes the movement of the grain loaded at Thunder Bay, since the average rather than the lower marginal costs are allocated to the top-off grain. Shipowners have confirmed that in practice the ocean rates charged for the grain loaded at Thunder Bay and used to top-off at the St. Lawrence port in fact currently reflect such an average cost allocation.

Exhibit D.3 presents the model results for total ocean freight costs to Antwerp/Rotterdam assuming four different backhaul percentages: 0%, 25%, 50% and 80%. The costs with backhaul have been obtained by adding the costs for extra port days required for loading and unloading the backhaul cargo to the costs with zero backhaul and by multiplying these new totals by backhaul factors defined as follows: backhaul factor = 100/(100 + % backhaul). This methodology assumes for simplicity that the backhaul cargo is loaded at the same port where the grain is unloaded and that the same

EXHIBIT D.3

ESTIMATED OCEAN FREIGHT COSTS TO ANTWERP/ROTTERDAM*

($CDN/tonne)

	0% BACKHAUL				25% BACKHAUL				50% BACKHAUL				80% BACKHAUL			
VESSEL TYPE FROM	Churchill	Montreal	Baie Comeau	Thunder Bay	Churchill	Montreal	Baie Comeau	Thunder Bay	Churchill	Montreal	Baie Comeau	Thunder Bay	Churchill	Montreal	Baie Comeau	Thunder Bay
25,000 DWT Non Ice-Strengthened Bulker	20.14	16.35	14.25	29.45	16.70	13.49	11.73	24.07	-	11.59	10.05	20.66	-	10.00	8.65	18.01
40,000 DWT Non Ice-Strengthened Bulker	17.17	14.07	12.30	-	14.33	11.67	10.19	-	-	10.08	8.78	-	-	8.75	7.61	-

DWT = Deadweight tonnes

* For a round trip

unit cost is allocated to the forehaul and backhaul traffic. In practice, obtaining backhaul cargo often requires a triangular haul; that is, after unloading grain the ship must sail empty to another port to load the backhaul cargo. The costs estimated using our model for the various percentage backhauls, therefore, may understate actual costs allocated to the forehaul grain in practice. The total cost results are discussed and compared with the corresponding ocean rates in section 3.2.7 in the body of this report.

Exhibits D.4 and D.5 present breakdowns of the total cost for each of the alternative grain export routes according to the following components: operating cost, capital charge, fuel cost, port charges, St. Lawrence pilotage fees, St. Lawrence Seaway tolls and the extra insurance premium for voyages to/from Churchill. Exhibit D.4 presents total cost by component for a single round trip voyage, while D.5 presents the same cost on a per tonne basis. The costs given are for the case of zero backhaul, but the proportions of total cost represented by each cost component would be similar under other backhaul scenarios due to the methodology outlined above used to estimate total costs with backhaul.

It is seen from these Exhibits that for each route and vessel type, operating cost, capital charge and fuel cost are the most important components of the total cost. Taken together, these three components constitute about 85% of the total cost for a grain voyage to Churchill and 91 - 93% of the total cost of voyages from Thunder Bay, Montreal and Baie Comeau. Port charges contribute between five and seven percent of the total cost for the vessels and routes considered. The main difference between the distribution of costs by component for Churchill and those for the alternative routes is that about eight percent of the total cost for Churchill is accounted for by the "historic" Churchill extra insurance premium. Complete elimination of this extra premium would reduce the total cost for the Churchill route by about $1.60 per tonne for the 25,000 DWT bulker and $1.25 per tonne for the 40,000 DWT bulker for a 7-8 percent cost reduction in both cases.

EXHIBIT D.4

BREAKDOWN OF ESTIMATED OCEAN FREIGHT COST TO ANTWERP/ROTTERDAM* FOR ZERO BACKHAUL: TOTAL COSTS
(Costs in $CDN)

VESSEL TYPE & ORIGIN	COST COMPONENT							
	OPERATING COST	CAPITAL CHARGE	FUEL COST	PORT CHARGES	GREAT LAKES/ ST. LAWRENCE PILOTAGE FEES	ST. LAWRENCE SEAWAY TOLLS	CHURCHILL EXTRA INSURANCE PREMIUM	TOTAL
25,000 D.W.T. Non Ice-Strengthened Bulker								
Churchill	143,000 (28.4%)	136,500 (27.1%)	149,000 (29.6%)	35,000 (7.0%)	- (0%)	- (0%)	40,000 (7.9%)	503,500 (100%)
Thunder Bay	183,800 (28.7%)	175,300 (27.4%)	201,700 (31.5%)	30,000 (4.7%)	40,000 (6.2%)	10,000 (1.5%)	- (0%)	640,800 (100%)
Montreal	122,500 (30.0%)	116,900 (28.6%)	134,500 (32.9%)	25,000 (6.1%)	10,000 (2.4%)	- (0%)	- (0%)	408,900 (100%)
Baie Comeau	107,800 (30.3%)	102,800 (28.9%)	120,700 (33.8%)	25,000 (7.0%)	- (0%)	- (0%)	- (0%)	356,300 (100%)
40,000 D.W.T. Non Ice-Strengthened Bulker								
Churchill	195,200 (28.4%)	210,400 (30.6%)	186,400 (27.1%)	45,000 (6.6%)	- (0%)	- (0%)	50,000 (7.3%)	687,000 (100%)
Montreal	166,400 (29.6%)	179,300 (31.9%)	168,300 (29.9%)	35,000 (6.2%)	13,500 (2.4%)	- (0%)	- (0%)	562,500 (100%)
Baie Comeau	147,200 (29.9%)	158,600 (32.2%)	151,200 (30.8%)	35,000 (7.1%)	- (0%)	- (0%)	- (0%)	492,000 (100%)

* For a round trip voyage

EXHIBIT D.5

BREAKDOWN OF ESTIMATED OCEAN FREIGHT COST TO ANTWERP/ROTTERDAM* FOR ZERO BACKHAUL: PER TONNE COSTS
(Costs in $CDN/tonne)

VESSEL TYPE & ORIGIN	COST COMPONENT							
	OPERATING COST	CAPITAL CHARGE	FUEL COST	PORT CHARGES	GREAT LAKES/ ST. LAWRENCE PILOTAGE FEES	ST. LAWRENCE SEAWAY TOLLS	CHURCHILL EXTRA INSURANCE PREMIUM	TOTAL
25,000 D.W.T. Non Ice-Strengthened Bulker								
Churchill	5.72 (28.4%)	5.46 (27.1%)	5.96 (29.6%)	1.40 (7.0%)	- (0%)	- (0%)	1.60 (7.9%)	20.14 (100%)
Thunder Bay	8.34** (28.3%)	7.96** (27.0%)	9.16** (31.1%)	1.36** (4.6%)	2.07** (7.1%)	0.56** (1.9%)	- (0%)	29.45** (100%)
Montreal	4.89 (30.0%)	4.68 (28.6%)	5.38 (32.9%)	1.00 (6.1%)	0.40 (2.4%)	- (0%)	- (0%)	16.35 (100%)
Baie Comeau	4.31 (30.3%)	4.11 (28.9%)	4.83 (33.8%)	1.00 (7.0%)	- (0%)	- (0%)	- (0%)	14.25 (100%)
40,000 D.W.T. Non Ice-Strengthened Bulker								
Churchill	4.88 (28.4%)	5.26 (30.6%)	4.66 (27.1%)	1.12 (6.6%)	- (0%)	- (0%)	1.25 (7.3%)	17.17 (100%)
Montreal	4.13 (29.6%)	4.48 (31.9%)	4.21 (29.9%)	.88 (6.2%)	.34 (2.4%)	- (0%)	- (0%)	14.07 (100%)
Baie Comeau	3.68 (29.9%)	3.96 (32.2%)	3.78 (30.8%)	.88 (7.1%)	- (0%)	- (0%)	- (0%)	12.30 (100%)

* For a round trip voyage
** Represents the cost allocated to the grain loaded at Thunder Bay, using the formula given on page D-6.

The information presented in Exhibits D.4 and D.5 obtained from the ocean bulk vessel cost model provides some insight into the nature of potential future changes in relative costs between the alternative routes. Because the three major components of total cost, namely operating costs, capital charges and fuel costs, are basically the same daily rates multiplied by the numbers of navigating and in-port days on each route, the relative values for each route can be affected only by relative changes in sailing days and in-port days. Thus, a relative decrease in vessel waiting and loading time at Churchill (from the current average of 5.2 days) is the only way in which the Churchill route could become more cost competitive with the other routes in the major categories of operating cost, capital charge and fuel costs. For the 25,000 DWT bulker, a one day reduction in average waiting and loading time at Churchill would result in a cost saving of about $.50 per tonne. Relative reductions in port charges at Churchill and increases in St. Lawrence Seaway tolls and in pilotage fees on the Seaway and on the St. Lawrence River would also improve the cost comparison for Churchill relative to the alternative routes, but the overall effects would be minor because the cost components involved comprise minor shares of the total cost. The establishment of significant backhaul cargo to Churchill could substantially improve its cost competitiveness with the other routes. For example, Exhibit D.3 shows that the cost for a 25,000 DWT bulker with 25 percent backhaul for the Churchill route is $3.44 per tonne or 17 percent less than the cost with zero backhaul. Reduction of the extra Churchill insurance premium, as discussed above, would likely have a somewhat significant impact on the relative cost competitiveness of ocean shipping from Churchill, offering up to an eight percent reduction in the ocean freight cost of exporting grain through Churchill.

APPENDIX E

CAPITAL AND OPERATING COSTS ASSOCIATED WITH SPECIAL RAIL CAR REQUIREMENTS FOR CHURCHILL

APPENDIX E

CAPITAL AND OPERATING COSTS ASSOCIATED WITH SPECIAL RAIL CAR REQUIREMENTS FOR CHURCHILL

In this Appendix the costs associated with the need to operate special cars on the Churchill line because of the limitations imposed on this line by the soil and permafrost conditions on the northern section of the route are examined. At the present time CN does not permit hopper cars to operate on this line. There are three options foreseen:

- o use only boxcars on the line in the future. Because of the high attrition rate of the existing boxcar fleet, this will probably imply the rehabilitation of additional boxcars over the next few years;
- o purchase new specialized equipment for the line such as the articulated hopper cars for which a prototype has been developed by CN on behalf of the Federal and Manitoba Governments;
- o refurbish the line so that conventional grain hopper cars can be used.

In the following sections, the cost implications of these various options are discussed with respect to Churchill shipment programs of different sizes. A more detailed analysis of the relative economics of these options is currently being performed by Transport Canada and CN and results are expected to be available in the spring of 1986.

CAPITAL COSTS

Exhibit E-1 shows the capital costs associated with the various car acquisition policies possible for movement to Churchill. 1985 dollars have been used. An annual interest rate of 11% has been assumed along with an estimate that each car can perform approximately 18 trips per year. This is based upon the current estimated cycle time for Churchill of approximately 20 days used by the Grain Transportation Agency (GTA) for

EXHIBIT E-1

CAPITAL COSTS OF CARS

HOPPER CARS	CAPITAL COST ($)	LOAD (TONNES)	CAPITAL COST/ TONNE ($)	LIFE (YEARS)	COST/YEAR/ TONNE ($)	TURNS	COST/ TONNE ($)
1. Articulated Hopper	$85,000	94	904.26	30	104.01	18	$5.78
2. Conventional Hopper	70,000	87	804.60	30	92.55	18	$5.14
3. Articulated Car required for Churchill only	85,000	94	904.26	30	104.01	4.5*	$7.70
BOXCAR REHABILITATION							
4. Roller Bearings	26,300	55	478.18	8	92.92	18	$5.16
5. Friction Bearings	16,300	55	296.36	5	80.19	18	$4.45
6. Friction Bearings for Churchill	16,300	55	296.36	20	37.22	4.5	$8.27

* Excess costs of $104.01/year/tonne above $92.55/year/tonne assigned to Churchill trips only and added to base cost of $5.14/tonne on trips to Churchill

planning purposes. As explained in the main body of the report, it is likely that if the same grain were moved to an alternate port, such as Thunder Bay, the cycle time would be similar. Churchill is open for approximately one-quarter of the year; therefore, cars that are moving grain to Churchill only will average approximately 4 1/2 cycles per year. Detailed assumptions associated with each of the lines of Exhibit E-1 are as follows:

1. Articulated hopper: The articulated hopper car has been estimated to cost some $85,000 and to have an average payload of approximately 94 tonnes. Based upon a thirty year life, an 11% interest rate and 18 turns per year, the cost per tonne is estimated at $5.78. Total capital cost is spread over all movements. This implicitly makes the assumption that the articulated hopper car would be used on branch lines on which there are load restrictions during times of the year outside the Churchill shipping season. If the articulated car were to cost $100,000 in 1985 dollars the cost per tonne would be $6.80.

2. Conventional hopper: The capital cost of a new hopper car is estimated at $70,000. In fact, during the current period of relatively low demand for rail freight, it is possible that hopper cars could be purchased or leased for less than this amount. However, to be consistent with the other options and because this situation probably will not continue far into the future, we have based our estimates on the estimated new cost of a conventional covered hopper car. Under present circumstances this type of car cannot be used on the Churchill line.

3. Articulated car required for Churchill only: It is possible that articulated hopper cars might have to be purchased for a Churchill movement and, during the remainder of the year, they would be used on services for which their special characteristics are not needed, that is, on lines on which there are no car weight restrictions and which therefore can be served by conventional hopper cars. In this case, all of the premium cost relative to conventional hopper cars should be attached to the Churchill movements such that the capital cost per tonne of grain delivered at Churchill works out to $7.70.

4. Boxcar with roller bearings: The estimated cost for rehabilitating boxcars and equipping them with roller bearings in order to meet CTC regulations is $26,300. Since this operation has not been performed before (boxcars have normally only been equipped with friction bearings), it is difficult to estimate the economic life that could be achieved. An eight year economic life for this type of rehabilitation seems to be reasonable as most of the problems associated with the aging boxcars occur in the running gear and most of this should be alleviated by the change of the type of bearing. The cars rehabilitated with roller bearings should therefore have a longer life than those rehabilitated but retaining friction bearings. The additional life of these latter cars has been estimated as five years. On this basis the total cost per tonne of grain delivered would be $5.16. This calculation assumes that the boxcar could be productively used at all times of the year. It is unclear at this time whether roller bearings will be required for the Churchill Fleet by the CTC.

5. Boxcar with friction bearings: If a boxcar is rehabilitated and re-equipped with friction bearings, in most recent analyses it has been assumed by CN and the GTA to have an economic life of another five years. In this case the capital cost is estimated to work out to $4.45/tonne of grain delivered. Again, this calculation assumes that the car could be used productively at all times of the year.

6. Boxcar with friction bearings used for Churchill movements only: If the boxcars cannot be used productively at other times of the year because of the limitation imposed by the friction bearings, then all the costs must be attributed to the shorter Churchill shipping season. At the same time, however, the cars should have a longer life. Since the cars would be operating one-quarter of the time, twenty years would appear to be the maximum life and, based upon a twenty year life, the cost per tonne delivered would be $8.27.

Refurbishment of the line to permit use of conventional hopper cars is an alternative to using special cars on the Churchill route. In 1982, the costs of such a refurbishment were estimated at some $15,000,000 ("Embankment Stabilization Research Program: Branchline Rehabilitation for the Hudson Bay Railway, Herchmer Subdivision", EBA Engineering Consultants

Ltd., September 1982) for a cryo-anchor system to stabilize the roadbed. In 1985 dollars this is approximately $17,500,000. If this is amortized over a thirty year life the annual cost in 1985 dollars would be approximately $2 million.

CN has suggested that this cost may be low because not all of the problem locations on the line have been identified. Costs could be much higher than originally estimated. Costs as high as $50 million have been mentioned. If the original cost estimate were to be arbitrarily doubled to $35 million to take into account this uncertainty, then the annual cost would be some $4 million per year.

OPERATING COSTS

The different types of cars also have implications in terms of their operating costs. A recent CTC report ("RTC Staff Report Concerning the Payment of the CN Adjustment to the Canadian National Railway Company in Respect of Crop Year 1985/86 Under the Western Grain Transportation Act", Report #REA-CD-85-01, February 1985) estimated the relative costs per loaded car-mile to be as follows:

Government hopper - $0.78237/loaded car-mile
CN boxcar - $0.72957/loaded car-mile

On a per tonne basis, of course, the operating costs for the boxcars are significantly more than for the hopper cars. Included in the extra costs of the boxcar are amounts for grain doors, car cleaning, additional fuel costs (on a per tonne of grain basis), etc.

Based upon the 954 mile one way trip distance from Saskatoon to Churchill, grain capacities as before (87 tonnes for conventional hopper cars and 55 tonnes for boxcars), the portion of the railway volume related costs associated with car-miles can be estimated as follows:

Conventional hopper car - $8.58/tonne
Boxcars - $12.65/tonne

The boxcar costs so estimated may be slightly high in that they contain a small element of capital costs associated with use of railway-owned boxcars but at the same time they do not include any additional primary elevator costs associated with loading boxcars. Therefore we have used the CTC estimates as given.

It therefore appears that on the Saskatoon-Churchill trip the conventional hopper cars have a potential operating cost saving advantage of $4.07/tonne.

Because there is no operating experience with the new articulated hopper cars, it has not been possible to estimate the operating costs that might be expected. It would seem that, with their extra wheels, articulated cars should have a higher maintenance cost than conventional hopper cars. At the same time, their modern design and construction implies that operating costs should be lower than for carrying the equivalent amount of grain in boxcars. Because these cars will have 50% more wheels than a conventional hopper or boxcar, an estimate of the upper bound of the car mile related costs is 1.5 times the boxcar costs or approximately $1.10/car mile. Based upon the same assumptions as before, (954 mile trip, 94 tonne payload), the car-mile related costs for the articulated hopper cars can be estimated at $11.16/tonne.

COMPARISON OF CAR TYPES

The information described above can be used to develop estimates of the relative costs associated with the different car types. Basic information is contained on Exhibit E-2. From this exhibit it can be seen that, although the total car related costs associated with articulated hopper cars are higher than those associated with conventional hopper cars, they are less than those associated with rehabilitated boxcars. It should

EXHIBIT E-2

DIFFERENTIAL COSTS OF VARIOUS CAR POLICIES

(a) CAR RELATED COSTS

	CONVENTIONAL HOPPER CAR	ARTICULATED HOPPER CAR	BOXCAR - ROLLER BEARINGS	BOXCAR - FRICTION BEARINGS
Car Capital Costs ($/Tonne)	5.14	5.78	5.16	4.45
Per Car-Mile Costs ($/tonne)	8.58	11.16	12.65	12.65
Subtotal	13.72	16.94	17.81	17.10
Excess of Cost over Conventional Hopper Car ($/tonne)	-	3.22	4.09	3.38

(b) LINE RELATED CAPITAL COSTS FOR REFURBISHMENT

	$17,500,000 COST ESTIMATE				
Churchill Annual Throughput (tonnes)	250,000	500,000	750,000	1,000,000	1,250,000
Cost per Tonne ($/tonne)	8.00	4.00	2.67	2.00	1.60
	$35,000,000 COST ESTIMATE				
Churchill Annual Throughput (tonnes)	250,000	500,000	750,000	1,000,000	1,250,000
Cost per Tonne ($/tonne)	16.00	8.00	5.33	4.00	3.20

also be remembered that these are based upon an estimate of the per car-mile costs of the articulated hopper cars which is most likely to be on the high side. These results are also sensitive to the capital costs of the articulated car. If the new cars were to cost $100,000 in 1985, the total cost per tonne delivered would be $17.96, higher than for either of the boxcar options.

Based upon the assumptions used, however, it appears that the purchase of articulated hopper cars would be preferable to rehabilitating boxcars if additional new cars are required for the Churchill movement and provided that these cars can be productively employed in other services during the remainder of the year.

The line related costs shown on Exhibit E-2 indicate that if the higher capital cost estimate for the rehabilitation of the Churchill line ($35 million or double the original estimate) is appropriate then the articulated hopper car option also would be cheaper than refurbishing the line for all reasonable scales of Churchill shipment programs. At the original cost estimate for refurbishing the line, there appears to be a breakpoint in the annual Churchill program in the range of 600,000 tonnes. For larger programs, on a sustained basis, the refurbishment of the line may be superior. For lower volumes, the purchase of articulated hopper cars would appear to be superior. This is true only if there are not sufficient boxcars available for Churchill. To the extent that existing boxcars are available for the Churchill line, without needing rehabilitation, their use would be preferable on that basis. This comparison is based on very preliminary information. More detail on the relative costs of the articulated cars should be available in a forthcoming study of the subject.

NUMBER OF CARS REQUIRED

The number of cars required for the Churchill movement is very much interconnected with the number of cars required for Prairie branch

lines where load restrictions are in effect. The following is a simplified analysis of the number of boxcars that would be required for Churchill programs of different sizes in the 1986/87 crop year and in 1991/92. Exhibits E-3 and E-4 show the expected situations for these two years respectively. The various sources and calculations for the derivation of the various lines on the graphs are explained below:

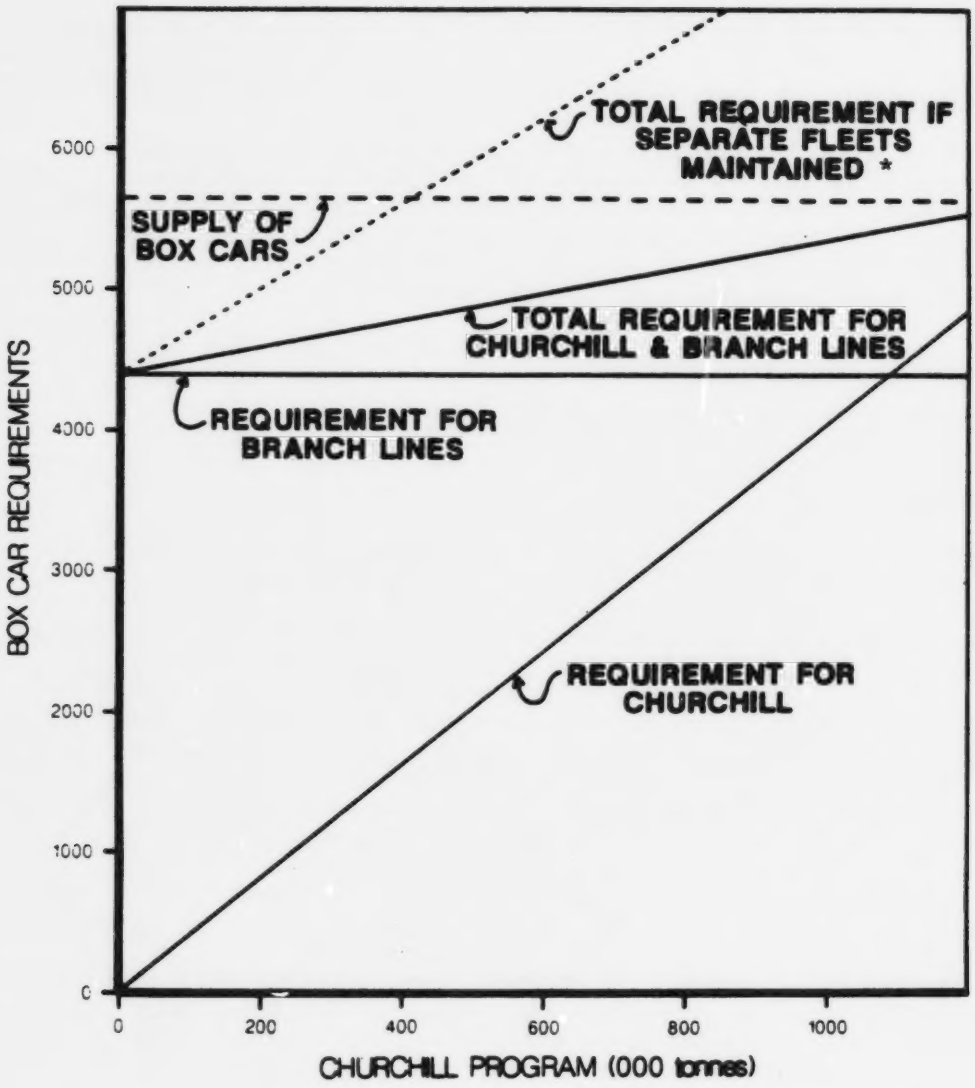
- o Requirement for Churchill. This is the number of cars that would be required for Churchill if there were no interaction with the cars required for branch line service. Essentially this is calculated on the basis that each boxcar could carry 55 tonnes per trip and average 4 1/2 trips during the Churchill shipping season. For example, if there is a Churchill program of 750,000 tonnes, 3,030 boxcars would be required (750,000/55/4.5);

- o Requirement for Branch Lines. The boxcar requirement for load restricted branch line operations is based upon the estimates produced by the Grain Transportation Authority ("Rail Boxcar Capacity Requirements to 1991", GTA, July 1983) and implicitly assumes that there is no Churchill movement;

- o Total Requirement for Churchill and Branch Lines. This line sums the Churchill and branch line requirements on the assumption that branch line operations for grain not moving to Churchill can be curtailed during the Churchill shipping season. Boxcars would be used on the Churchill movement as required. Only the remaining boxcars would be used for movements off of non-Churchill branch lines during the Churchill season. During the remainder of the year when Churchill is not in operation, additional cars will be required to serve these branch lines because not all of the grain held on farms and/or accumulated in primary elevators during the Churchill season will have been moved off of the remaining branch lines during the Churchill season. Based upon an estimate that 25% of the grain to be moved to Churchill will come off light load branch lines, the total requirement of boxcars for branch lines and Churchill is approximately 23% more than that required for the branch lines alone, up to the point where this line intersects the Churchill requirement line. From this point beyond, the total boxcar requirement is equal to the Churchill requirement;

exhibit E-3

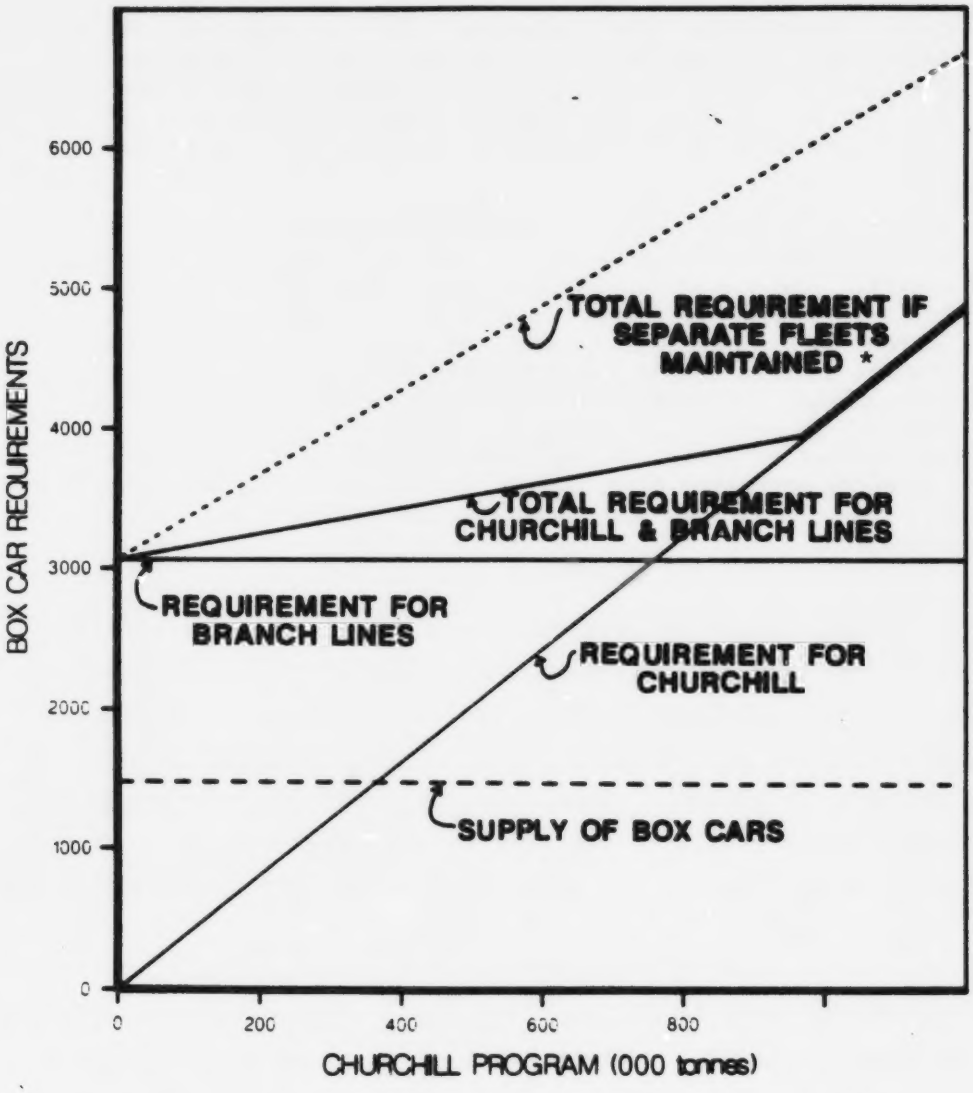
1986/87 BOX CAR REQUIREMENTS



* e.g. If branch line operations requiring boxcars cannot be curtailed during the Churchill Season, such that two separate boxcar fleets would have to be maintained, for the branch line and Churchill programs.

exhibit E-4

1991/92 BOX CAR REQUIREMENTS



* e.g. If branch line operations requiring boxcars cannot be curtailed, during the Churchill Season, such that two separate boxcar fleets would have to be maintained, for the branch line and Churchill programs.

- Total Requirement if Separate Fleets Maintained. This is the total requirement if branch line operations cannot be curtailed during the Churchill shipping season. In this case, essentially two separate fleets have to be maintained, for the branch line and Churchill programs. The only reduction in the total cars needed compared with the sum of the two requirements would occur because of those movements going to Churchill from load restricted branch lines;

- Supply of Boxcars. This is the total supply of boxcars of both railways as estimated by the GTA in their 1983 report. The use of this line on the graph implies that CP boxcars could be made available for movements to Churchill. This, of course, has been recommended by several studies but the arrangements have not yet been put into place. A trial interchange allowing CP boxcars to move to Churchill took place in 1978. At that time the savings were judged to be insufficient to justify the increased operating difficulties. This may not be the case in the future as the boxcar fleet experiences more attrition.

In 1986/87, there are predicted to be enough boxcars available in total to supply the Churchill movement pattern for all scales of Churchill programs to more than 1,000,000 tonnes. Therefore there are no additional railway car costs and per car-mile operating costs associated with the Churchill movement in 1986/87. There will be sufficient boxcars in the fleet and these boxcars will be operated in any case, with or without a Churchill program as long as the total capacity of the grain fleet is required.

In 1991/92, this is no longer the case. Additional cars will be required to serve Churchill. Exhibit E-5 shows the cost implications for programs of various sizes, making the assumption that friction bearing boxcars will be rehabilitated for the Churchill movement (and will be permitted by the CTC) and that these cars will be used for other movements during other times of the year. If the boxcars had to be rehabilitated with roller bearings the costs would be higher than shown in Exhibit E-5.

EXHIBIT E-5

TOTAL RAIL CAR IMPLICATIONS

OF ALTERNATIVE CHURCHILL PROGRAMS

USING BOXCARS IN 1991/92

Size of Churchill Program (Thousand Tonnes)	250	500	750	1,000	1,250
Additional Boxcars Required (beyond those needed for branch line service - see Exhibit E-3)	232	465	697	929	1,162
Annual Car-Related Costs compared with Conventional Hopper Cars (based on cost differential of $3.38/Tonne) ($ million)	$0.776	$1.556	$2.332	$3.109	$3.888

The additional annual car related costs, compared to conventional hopper cars, can be seen to vary between $1 and $3 million, depending upon the size of the Churchill program. This can be compared with the estimated $2 to $4 million annual cost of refurbishing the line as well as with the additional annual costs associated with articulated hopper cars.

Exhibit E-6 shows a similar analysis for articulated hopper cars. In this case it should be recalled that the per car mile cost associated with the use of articulated hopper cars is probably on the high side. These costs can be seen to be slightly lower than those associated with rehabiliting boxcars. Again, the costs of operating the articulated hopper cars compared with the costs of using conventional hopper cars have been included for the entire year. These costs can be compared with the estimated $2 to $4 million annual cost of refurbishing the line.

In this analysis, the implicit assumption has been made that grain shipments from weight restricted branch lines, other than those to Churchill, can be cut back during the Churchill shipping season. This may imply that there will be a greater storage of grain on these other branch lines, either in the primary elevators or on the farms, than would otherwise be the case. The larger inventory in these locations should be offset by lower inventories in the areas shipping to Churchill so that the total inventory held and storage charges should be similar. There may, however, be some differential impacts. If these become significant, some sort of compensating mechanism may have to be put into place.

CONCLUSION

It should be emphasized that the costs shown in this appendix are very preliminary. The results should be analyzed when new information becomes available, particularly concerning the capital and operating costs of the articulated hopper cars and the costs of refurbishment of the Churchill line.

EXHIBIT E-6

TOTAL RAIL CAR IMPLICATIONS

OF ALTERNATIVE CHURCHILL PROGRAMS

USING ARTICULATED CARS IN 1991/92

Size of Churchill Program (Thousand Tonnes)	250	500	750	1,000	1,250
Articulated Cars Required (beyond those required for branch line service*)	136	272	408	544	680
Annual Car-Related Costs compared with Conventional Hopper Cars (based on cost differential of $3.22/Tonne) ($ million)	$0.765	$1.529	$2.293	$3.058	$3.823

* Boxcars converted to articulated cars at ratio of carrying capacities.

However, from this analysis it appears that the relative costs of rehabilitation of boxcars and the acquisition of new hopper cars are very close. The refurbishment of the line appears to be more expensive, unless there are very large volumes of grain or other commodities moving on the line to share the costs.

APPENDIX F

PORT OF CHURCHILL GRAIN HANDLING MODEL

APPENDIX F

PORT OF CHURCHILL GRAIN HANDLING MODEL

As part of this study, a computer model was developed that would replicate the grain handling movements through the Port of Churchill. Presently, grain arrives at the Port where it is unloaded from trains and then processed and cleaned before being stored. Ships arriving at Churchill enter the harbour on an ebb tide and berth in one of three available locations. If enough of the desired grain is available then the ships proceed to load. Upon loading completion, the ships wait for a high tide condition then leave the dock and proceed out of the harbour.

DESCRIPTION OF THE MODEL

The computer model accounts for all of these movements by using four separate submodels that are linked and then run consecutively. The key linking model is the state program which continuously monitors changes in state conditions such as the amount of clean and dirty grain of each type presently available in the elevators and other interim continuous change variables. The state program monitors any changes that have occurred in the continuous change variables.

Three submodels are used to model train, ship, and elevator operations. The train arrival/unloading subroutine causes trains loaded with particular grain types and tonnages to be created and then directed to the Port of Churchill. Upon arrival, the trains are unloaded if elevator capacity is available.

The elevator submodel determines the worker availability for the train unloading, grain cleaning and ship loading processes. The working schedule can be arbitrarily set by the user and allows changes in hours of work per day and days of work per week. Also, a maximum number of working days can be assigned if desired.

The ship loading submodel directs the arrival, loading and departure of ships to the Port. Ships of varying sizes and grain demands are created and directed to the Port. The arrival pattern to the Port is set by the user. Ships wait for an ebb tide and proceed to the docks where three berths are available. If these berths are occupied, then ships wait outside the harbour until a berth becomes available. Once ships have docked they proceed to load if enough grain of their grain type is available. Upon completion of loading, the ships wait for a high tide condition, then depart the harbour.

In order to analyze each run of this grain handling model, a number of output variables are specified and are "tracked" throughout the run of the model. These include grain tonnage information, time of ship arrival, time of ship departure, grain loading time and other counters such as number of ships served, number of trains unloaded, etc. This information can be analyzed using the model's own output analyzer or can be rewritten into a computer data format, readable by a computer spreadsheet program such as Lotus.

ASSUMPTIONS

In order to model the activities within the Port of Churchill a number of basic assumptions concerning loading rates, capacities, etc., were made. The assumptions are broken down into the three submodel categories.

Train Arrival/Unloading/Cleaning

Key assumptions for this submodel are given below:

- grain unloading capacity - 1,200 tonnes per hour;
- grain cleaning capacity - 1,000 tonnes per hour;

- o train arrivals - defined by user;
- o maximum train load - 8,800 tonnes.

Ship Arrival/Loading

The key assumptions for the ship submodel are given here:

- o grain loading capacity - 300 tonnes per belt per hour;
- o number of belts - 4 (total capacity = 1,200 tonnes per hour);
- o number of berths - 3;
- o number of loaders - 1;
- o tide range (high - low) - 4 meters;
- o tide cycle - approximately 12.6 hours per day.

Elevator Submodel

There are three basic assumptions for the elevator submodel. These are the length of work shift, length of work week and number of days per season. These can be defined by the user but for all model runs have been standardized for the purposes of this analysis. Initially, all operators were assigned a twelve hour work shift per day and a six day work week. The maximum number of days of work per season has been set at 120. These values have been assigned to all workers. It is possible to vary the work schedules for each type of worker; i.e., train unloaders, grain cleaners, ship loaders.

Other Assumptions

Information on train arrival and ship arrival movements is input by the user. Therefore, arrival scenarios can be varied to suit the needs of the analysis. Input parameters necessary for train arrivals are the

train number, time to next train arrival, grain type and grain tonnage. Similarly, the ship arrival scenario requires the ship number, the time to next ship arrival, the required grain type and the grain tonnage. Many different scenarios for grain movement through the Port of Churchill are possible by varying the arrivals of either trains or ships or both, if desired.

CALIBRATION TO 1985 SHIPPING SEASON

In order to check the accuracy of the model, the ship arrival and grain tonnage parameters for the 1985 shipping season were input and used to calibrate the model. In order to explain delays in loading of ships at the beginning of the season because of a lack of grain, an appropriate train arrival scenario was developed and input. The results of the first model run indicated an average ship time in port of 108 hours compared with an actual of 143 hours. The average time to load was 46.6 hours which is much lower than the 1985 average of 76.7 hours. This lower average time indicated by the model suggests that the maximum loading rates are not achieved, possibly due to interruptions and machine breakdowns. Therefore, the model was refined by calibrating the shiploading workers shift length to 10 hours and by reducing the shiploading rate from 1,200 tonnes/hour to 900 tonnes/hour. As a result the new modelled average time in Port was 149 hours.

APPLICATIONS

A useful application of this model is to determine the maximum grain throughput of the Port under different train and ship arrival scenarios. It will be evident that the grain handling capacity is dependent upon the train arrivals of grain and the ability to clean this grain, thus making it available for ship loading. This assumes that ships are always available in the harbour waiting for an available berth to commence loading of grain.

Another variation that can be examined is the potential delay to loading caused by high and low tide conditions. Built into the model is a submodel that checks the capacity of a ship that is about to be loaded and determines whether it can commence loading at high tide, or if it will have problems completing loading at low tide conditions. Presently, ships over 40,000 tonnes capacity may have these loading difficulties due to the height of their deck above the waterline. The model will delay the commencement of loading or the completion of loading, depending upon the tide condition for ships above this capacity. Therefore, it would be possible to modify the harbour conditions by dredging so that these loading difficulties would not occur. This could then be modelled by eliminating the need for ships to wait for start and completion of loading due to tide conditions. The increase in the number of ships served per season could then be determined.

These and other applications are possible as well as any other ranges of train arrival and ship arrival scenarios. Adjustments in the working schedules or the grain unloading/loading/cleaning rates are possible which would also affect the throughput of the Port.

APPENDIX G

ESTIMATED TOTAL RATES COMPARISON FOR MOVING WHEAT FROM SASKATOON TO A MEDITERRANEAN PORT (MARSEILLE)

APPENDIX G

ESTIMATED TOTAL RATES COMPARISON FOR MOVING WHEAT FROM SASKATOON TO A MEDITERRANEAN PORT (MARSEILLE)

This Appendix presents a comparison of the total estimated transportation and handling rates for exporting wheat to Mediterranean ports. In the comparison, we have used Marseille, France as a representative Mediterranean port (Marseille has occasionally received some Canadian export grain).

Because voyage charter ocean freight rates to Marseille via the three alternative export routes considered were not available, it was necessary to estimate these rates based on relative ocean costs to Marseille calculated using the ocean bulk vessel cost model described in Appendix D. Exhibit G.1 presents these estimated ocean freight costs from Churchill, Montreal and Thunder Bay to Marseille under three different backhaul scenarios: 0, 25 percent, and 50 percent backhaul. Comparing these costs with those estimated to Antwerp/Rotterdam given in Exhibit 3.11 of the main report, it is seen that the costs to Marseille are higher than the costs to Antwerp/Rotterdam by the following percentages for 25,000 DWT non ice-strengthened bulkers for each alternative route:

Churchill (0% backhaul)	22%
Montreal (50% backhaul)	15%
Thunder Bay (50% backhaul)	5%

Assuming that the ocean rates to Marseille would be higher than those to Antwerp/Rotterdam by the same proportions as ocean costs to Marseille are higher, the above percentages have been applied to the known average ocean rates to Northwestern Europe (given in Exhibit 3.7 of the main report) to obtain estimates of the ocean rates to Marseille in various years. These are shown in Exhibit G.2, which compares the estimated total

EXHIBIT G.1

ESTIMATED OCEAN FREIGHT COSTS TO MARSEILLE, FRANCE*
($CDN/tonne)

FROM / VESSEL TYPE	0% BACKHAUL			25% BACKHAUL			50% BACKHAUL		
	Churchill	Montreal	Thunder Bay	Churchill	Montreal	Thunder Bay	Churchill	Montreal	Thunder Bay
25,000 DWT Non Ice-Strengthened Bulker	24.62	18.95	31.42	20.28	15.57	25.54	-	13.32	21.63
40,000 DWT Non Ice-Strengthened Bulker	20.90	16.24	-	17.31	13.41	-	-	11.53	-

DWT = Deadweight Tonnes

* For a round trip

EXHIBIT G.2

RATES (INCLUDING FULL RAIL RATES) FOR MOVING WHEAT FROM SASKATOON, SASK. TO THE MEDITERRANEAN (MARSEILLE) UNDER DIFFERENT SCENARIOS FOR OCEAN RATES
(1985 $/Tonne)

SCENARIO		VIA CHURCHILL	VIA THUNDER BAY DIRECT	VIA THUNDER BAY & ST. LAWRENCE PORT
	Country Elevator	8.50	8.50	8.50
	Rail Rate			
	- shipper portion*	5.70	5.90	5.90
	- federal contribution	20.95	21.67	21.67
	- SUB-TOTAL	26.65	27.57	27.57
	Terminal Elevator	8.80	7.80	7.80
	Lake Transportation	-	-	16.00
	Transfer Elevator	-	-	5.10
	SUB-TOTAL (to Export Position)	43.95	43.87	64.97
i) Low Market for Ocean Freight (Current Rates)	Ocean Freight***	18.70	23.30**	12.80
	GRAND TOTAL	62.65	67.17	77.77
ii) Medium Market for Ocean Freight	Ocean Freight***	28.30	39.20**	16.80
	GRAND TOTAL	72.25	83.07	81.77
iii) High Market for Ocean Freight	Ocean Freight***	48.10	52.28**	27.60
	GRAND TOTAL	92.05	96.15	92.57

* 1985 shipper proportion of rail rate is low reflecting substantially reduced export volumes
** includes $0.83/tonne in SLSA cargo tolls
** Estimated; based on relative ocean costs to Marseille for the alternative routes calculated using the ocean bulk vessel cost model described in Appendix D.

rates paid by shippers for moving wheat from Saskatoon to Marseille under the three different ocean freight market scenarios.

The results in Exhibit G.2 indicate that shipping through Churchill provides the lowest total rate for movement to Mediterranean ports under all three types of ocean freight markets. However, in a high market the comparison is very close, with Churchill providing a total rate saving of only about $0.50 per tonne over the next lowest alternative of shipping via Thunder Bay with transshipment at a St. Lawrence Port. For the low and medium market scenarios, the total rate savings available by using Churchill (about $4.50 per tonne and $9.52 per tonne respectively) are also somewhat lower (by $2.33 per tonne and $2.90 per tonne respectively) than the corresponding total rate savings available to Northwestern Europe (shown in Exhibit 3.14).

The conclusion from these results is that while exporting grain through Churchill to Mediterranean ports provides total rate savings to shippers relative to alternative routings through Thunder Bay, the savings available are less than for shipment to Northwestern Europe and are negligible in a high ocean freight market. Maximum rate savings would be achieved by using Churchill mainly as an export port to destinations in Northwestern Europe and the Baltic region.